Tracheo-Bronchoscopy, Esophagoscopy and Gastroscopy.

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E B Benedict

from the author

1933

Tracheo-Bronchoscopy, Esophagoscopy and Gastroscopy.

BY

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WITH FIVE COLORED PLATES AND MANY ILLUSTRATIONS.

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TO THE
FATHER OF BRONCHOSCOPY,
PROFESSOR GUSTAV KILLIAN,
AS A TOKEN OF ESTEEM,
THIS BOOK IS DEDICATED.

Preface.

The time has come when not only the profession but also the public demands that every laryngologist shall be expert at the removal of foreign bodies from the trachea, bronchi, esophagus and stomach. The day has come when the treatment of diseased organs, especially chronically diseased organs, without looking at them is regarded as a groping in the dark that is permissible only in organs that cannot be safely examined.

The esophagus has been for some years granted, though somewhat grudgingly, a place among the organs to be examined. The trachea and bronchi, owing to the initiative of Professor Gustav Killian, have been recently accorded a place also. Lastly it has been the author's privilege to demonstrate the ease with which the stomach may be examined by endoscopy.

At the present time, the only available information in the English language on these subjects is the reports of cases scattered through the journals. These reports do not give working data by which the student may learn how to proceed. This book is intended to furnish this information, and is not in any sense exhaustive. It is preliminary to a complete work, which the author has in preparation.

While the author realizes that there are men more capable of writing on the subjects, yet, as they have not done so, this little book is offered with a full realization of its shortcomings, but also with the assurance that every assertion therein, not attributed to someone else, is the result of practical experience.

Thanks are due to Dr. John W. Boyce and Dr. Ellen J. Patterson for aid.

CHEVALIER JACKSON.

Pittsburgh, Pa., March, 1907.

Introduction.

By direct laryngoscopy is meant the direct examination of the interior of the larynx, in contradistinction to indirect laryngoscopy by which a reflected image of the larynx is examined. Direct laryngoscopy is practiced with the aid of various instruments which serve to drag out of the way the anatomical structures which ordinarily obstruct the view.

By tracheo-bronchoscopy is meant the inspection of the interior of the trachea and bronchi with the aid of tubes which serve as specula, bringing into view successively the various passages, by pushing aside structures that would obstruct the view, or dragging the passages into a new position where they will be in the direct line of vision.

When the tubes are introduced through the natural passages, the procedure is spoken of as upper tracheo-bronchoscopy, as distinguished from lower tracheo-bronchoscopy in which the tubes are passed through a tracheotomy wound.

By esophagoscopy is meant the inspection of the interior of the esophagus with the aid of long tubes which serve as specula. It is almost always practiced through the natural passages.

By gastroscopy is meant the inspection of the interior of the stomach by means of tubes which serve as specula. It is usually practiced through the natural passages, though it is occasionally done through an abdominal wound or fistula.

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Part I.

CHAPTER I.

Historical Notes.

Bozini in 1807 examined the upper end of the esophagus.

Voltolini and Waldenberg, in 1860, and Stoerck, in 1861, devised esophageal specula using the laryngeal mirror.

Kussmaul, in 1868, did the first esophagoscopy worthy of the name, using a Desormeaux urethroscope elongated to 43 cm. He diagnosticated a carcinoma of the thoracic esophagus and approached the cardia. His tube was rigid and he used the "sword swallowing" position.

Trouvé, in 1873, designed a "polyscope" consisting of a tube having a window, and fitted with prisms and lenses constituting an optical apparatus. This was used by Ledentu and Raynaud for esophagoscopy.

Mikulicz, in 1881, with the aid of Mr. Leiter, designed an esophagoscope consisting of a tube into which an optic apparatus was slid after the removal of the mandrin used to facilitate introduction of the tube into the esophagus. He also examined the stomach with an elongated form of his esophagoscope by adding an angle and an additional prism.

Gottstein, in 1891, advocated esophagoscopy under cocain anesthesia. Prior work having been all done under either general anesthesia or morphin narcosis, mostly the latter.

Von Acker, in 1902, reported the first cases of tracheoscopy worthy of the name.

Mikulicz, in 1896, reported successful cases of tracheoscopy.

Kirstein, in 1897, described tracheoscopy as well as his now well known direct laryngoscopy. For the latter he used at first a tubular spatula.

Killian, in 1897, removed a foreign body from a bronchus and demonstrated the feasibility of upper bronchoscopy. Later he developed lower bronchoscopy. These were the greatest steps in endoscopy.

Coolidge, in 1899, reported the removal of a fragment of a tracheotomy canula from the right bronchus of a man.

V. Schrötter and Piniazek, in 1901, reported some excellent work in lower tracheoscopy and bronchoscopy.

Einhorn, in 1902, devised an esophagoscope having an auxiliary tube made in the wall of the main tube. In the auxiliary tube was inserted a light carrier which served as a double conducting wire to carry current to the electric lamp which it carried to the distal end of the tube.

Guisez, in 1903, removed a nail from a tertiary bronchus.

Ingals, in 1904, used a separate light carrier in a Killian tube and removed a pin from a bronchus of a woman.

Chevalier Jackson, in 1904, combined the lighting principle of the Einhorn esophagoscope with the tube of Killian, and in 1905 he designed a bronchoscope in which, in addition to the auxiliary canal, a drainage canal was placed. In 1906 he described a gastroscope he had devised and reported a series of 14 cases in which he had obtained results of value from gastroscopy, including 12 cases with lesions, one in which a lesion could be positively excluded and one case of extraction of a foreign body from the stomach.

The foregoing is not by any means a complete review of the history of the subject. Only a few of the more notable events are given. The reader interested in the history is referred to the almost complete bibliography appended.

CHAPTER II.

Instruments.

The instruments in use to-day for tracheo-bronchoscopy and esophagoscopy may be divided into two classes:

1. Those without lighting apparatus, consisting of a tube into which light is projected from an independent source of light, usually a head lamp. These instruments are simple and very satisfactory for short tubes. For very long tubes great skill and much practice are required, and beyond 50 cm. they are impracticable on account of the loss of light through distance, bubbles of secretion, etcetera. The object, be it normal, pathologic or foreign substance, is too feebly illuminated to throw back a strong image. All of these disadvantages are overcome by great skill. Killian and von Schrötter, who have done the greatest amount of upper bronchoscopic work, which requires long tubes of small diameter, use this form of tube.

2. In the other class of instruments the light is at the distal extremity of the tube where its full power is available practically without loss through distance, and where its obliquity renders visible otherwise unobservable details. Einhorn and Glucksman have used this form for the esophagus, and the author has perfected a bronchoscope and a gastroscope which utilize the great advantages of this plan of illumination.

INDEPENDENT ILLUMINATORS.

Kirstein's headlamp (Fig. 1) is the most used form. It consists practically of a combination of a Wendell C. Phillips electric headlight and a miniature form of the ordinary forehead mirror. The parallel rays emerging from the lens instead of being projected directly toward the object are caught upon a small mirror set at 45° which reflects the rays parallel with the line of vision of the observer's eye, the mirror having a small aperture which is placed in front of the pupil.

The headlight of Guisez (Fig. 2), consists essentially of three Phillips headlights clustered around the visual aperture of the disc on which

they are mounted, the axes of the lamps converging slightly. The light from this apparatus is excellent, the heat very slight, and annoying random rays are absent. There is a disc to obstruct the view of the left eye, useful for those unaccustomed to ignore the image of the left eye while using the right.

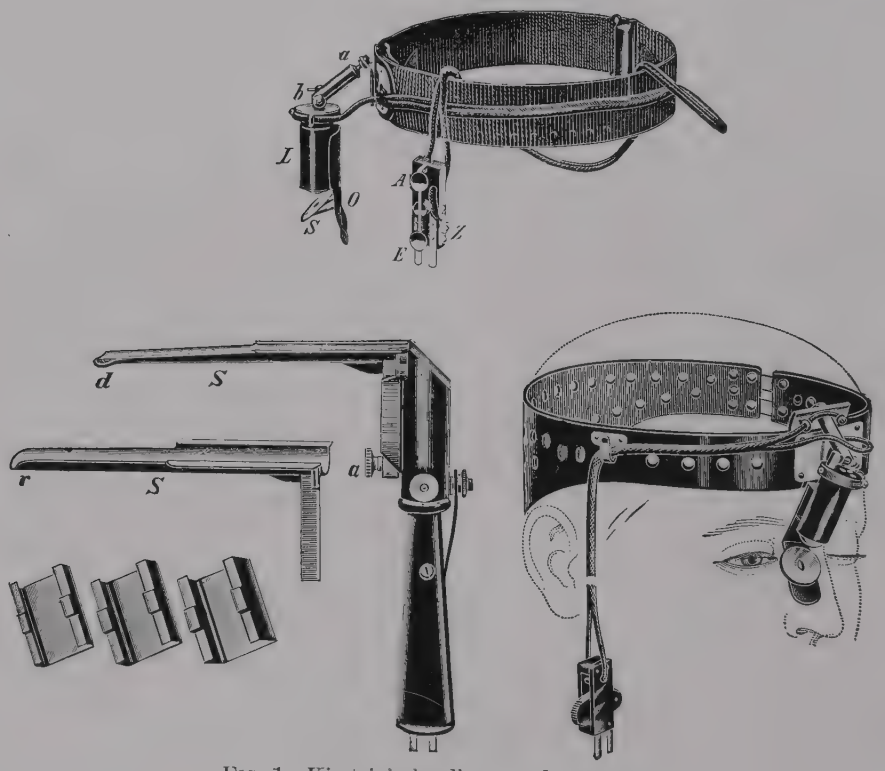


FIG. 1—Kirstein's headlamp and autoscope.

The electroscope of Casper is virtually a handlamp form of its successor, Kirstein's headlamp, a prism occupying the place of the mirror. Half of the orifice of the tube is occluded by the cap of the lamp, thus interfering with instrumentation; but for demonstration and for the introduction of unilluminated tubes which are to be used later with the headlamp, it is useful.

TUBES.

Kirstein used originally a tubular spatula attached to a Casper's handlamp for direct laryngoscopy, but afterward abandoned the tubular form for an open spatula with a hood at the proximal end.

Killian uses the tubular form (Fig. 3) with the Kirstein head-

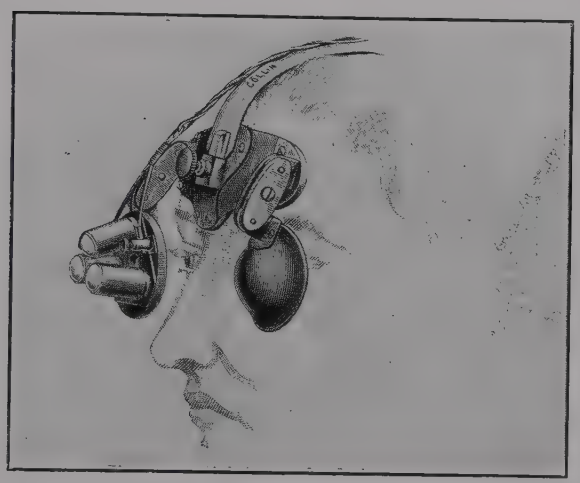


FIG. 2.—Guisez's headlamp.

FIG. 3.—Killian's tubular spatula.

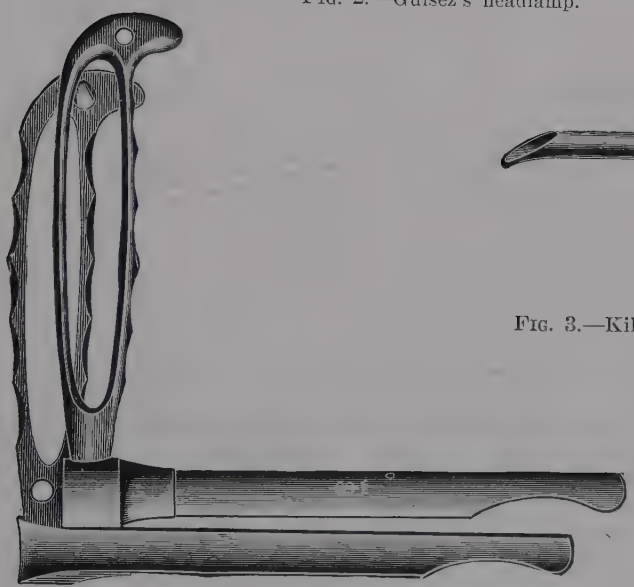


FIG. 4.—Killian's split tubular spatula.

light. He has designed a most ingenious split tube spatula (Fig. 4) to facilitate the introduction of tubes into the trachea, the two halves of the split spatula being separated for removal of the spatula after the distal end of the bronchoscope has passed the glottis. Six tubular spatulæ, 3 sizes solid and 3 split, are listed by the manufacturer, F. L. Fischer, Freiburg im Breisgau.

Mosher has devised a most ingenious speculum (Fig. 5) for work

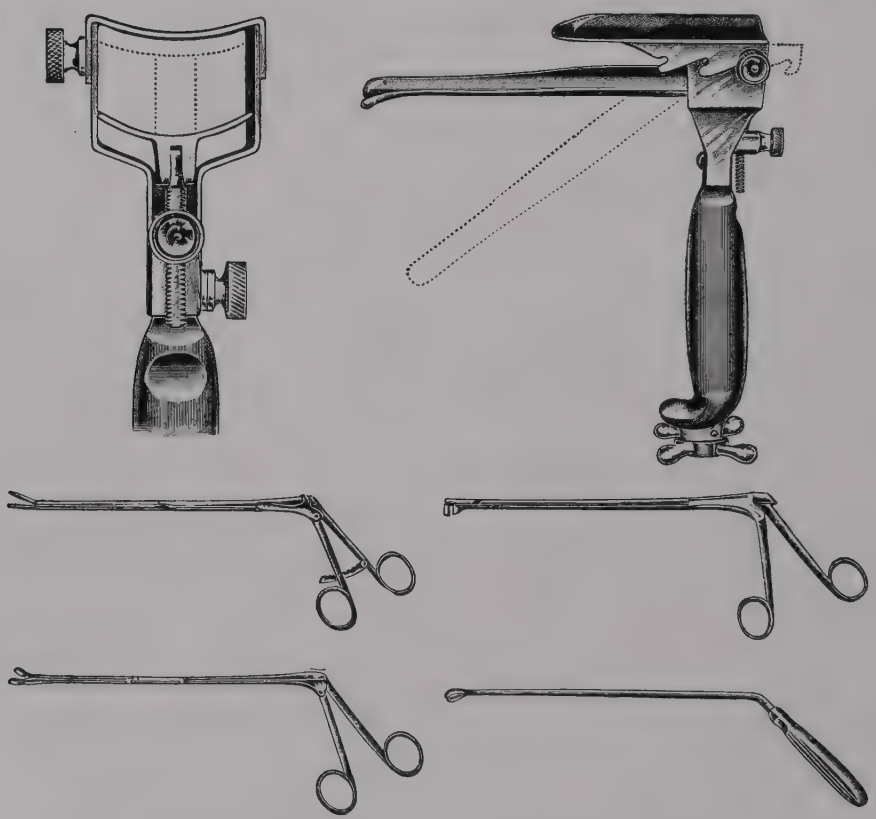


FIG. 5.—Mosher's esophageal speculum and instruments for the surgery of the upper end of the esophagus.

about the upper end of the esophagus. It is used with the Kirstein or Phillips headlight, or even with the forehead mirror, if for any reason this should be necessary.

The author uses a self-illuminating tubular speculum (Fig. 6) having a drainage tube made in its wall which maintains the field of observation, clean and free from secretion, and prevents the necessity for interrup-

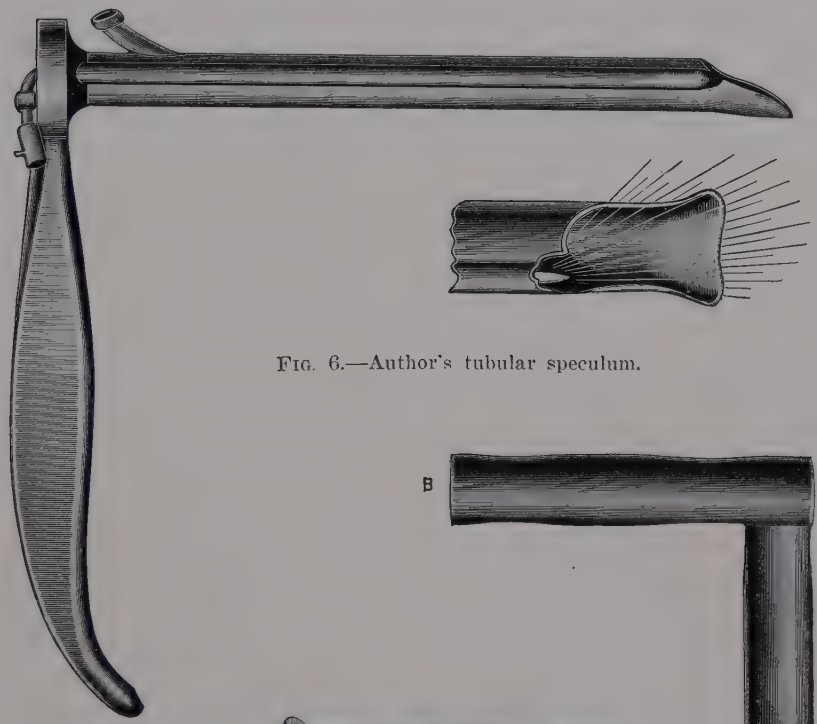


FIG. 6.—Author's tubular speculum.

FIG. 7.—Author's separable speculum for passing bronchoscopes. Handle, A B, is only used on the sitting patient.

tion for the patient to expectorate, the constant desire to do which is the source of more discomfort to the patient than any other part of direct laryngoscopy. For the introduction of tubes he uses a split spatula patterned after the ingenious device of Killian, but having it separable in the other direction, so as to avoid wounding the mucosa. (Fig. 7) It is made in two forms, one is self-illuminated, the other is not.

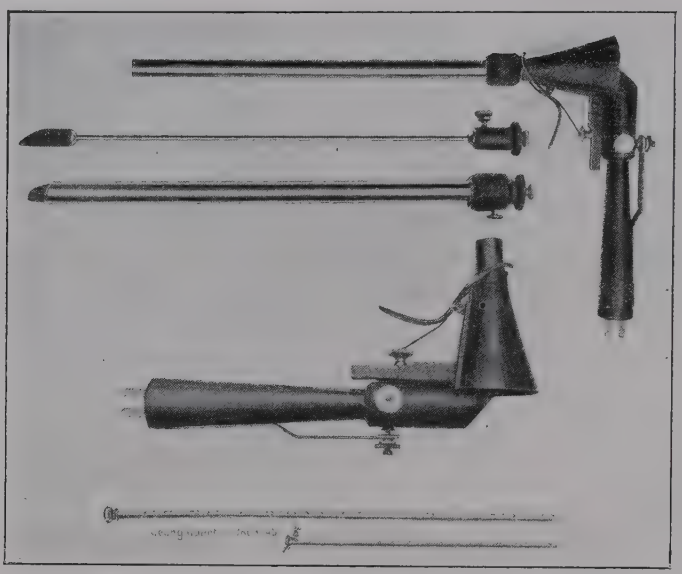


FIG. 8.—Mikulicz's esophagoscope, mandrin and (next to bottom) "practice bougie." The handle portion is a Caspar handlamp.

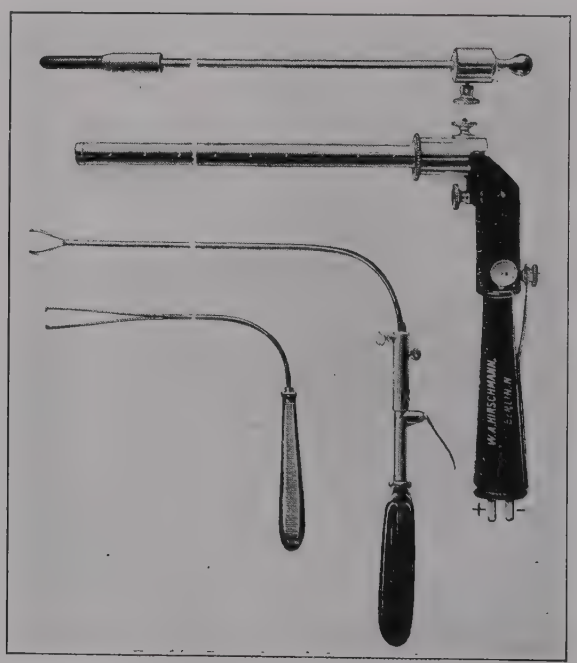


FIG. 9.—Rosenheim's esophagoscope, mandrin forceps and cotton holder.

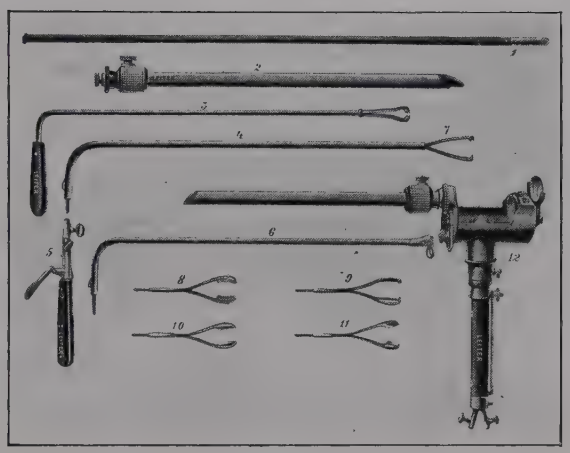


FIG. 10.—von Hacker's esophagoscopic instruments.

1. Ivory-tipped bougie. 2. Tube with mandrin in place. 3. Cotton holder. 4 and 7. Forceps. 5. Forceps handle. 6. Jointed curette. 8, 9, 10, 11. Forceps jaws. 12. Leiter's panelectroscope attached to tube.

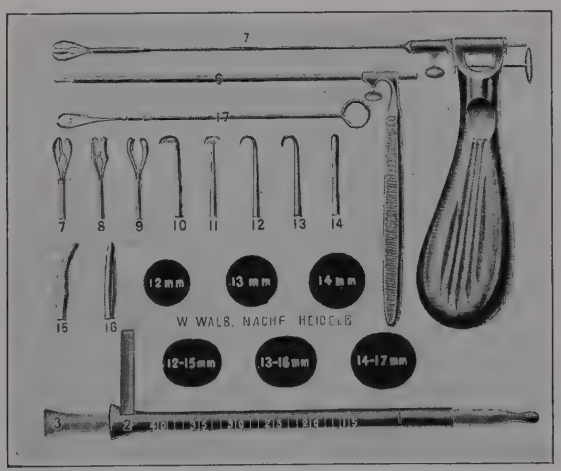


FIG. 11.—Starck's esophageal instruments.

2. Esophagoscope. 3. Mandrin. 4. Handle for forceps. 5. Handle for sounds and foreign body hooks. 6. Shank for sounds and foreign body hooks. 7. Sharp forceps for removal of specimens. 8. Corrugated forceps. 9. Mouse-toothed forceps. 10 to 16. Sounds and foreign body hooks. 17. Cotton holder.

Mikulicz, whose work is mainly esophageal, uses straight metallic tubes, the distal ends of which are cut off slantingly. (Fig. 8.) They are fitted with a mandrin tipped with a soft rubber pilot. The inside of the tube is blackened to prevent annoying reflections. For illumination he uses the Casper handlamp.

Rosenheim uses a similar tube and illuminator. (Fig. 9.)

Von Hacker for the esophagus uses a similar tube but uses the Leiter panelectroscope, a half open cylindroid box with mirrors. (Fig. 10.)

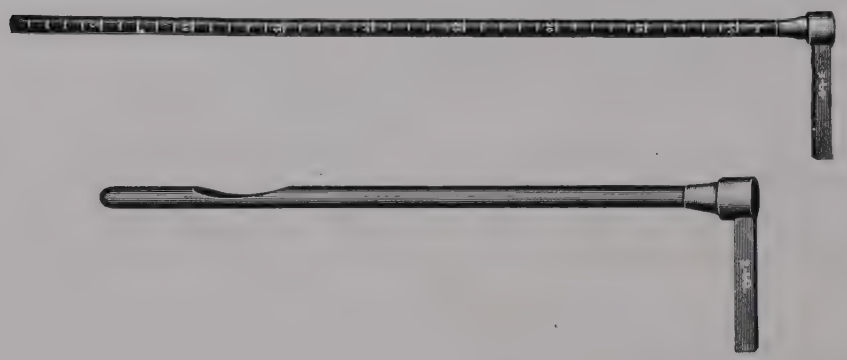


FIG 12.—Killian's bronchoscope and (below) Kirstein's esophagoscope with window.

Starck's esophageal tubes, shown in Figure 11, have no fitted mandrin, a form of esophageal sound being used as a pilot.

Killian's tubes (Fig. 12) are designed especially for the trachea and bronchi, the systematic exploration of which dates from Killian's original demonstrations. He uses straight rigid tubes of plated copper, graduated in centimeters outside, and highly polished inside. They all fit into a universal handle. (Fig. 13.) The sizes of Killian's tubes for bronchoscopy

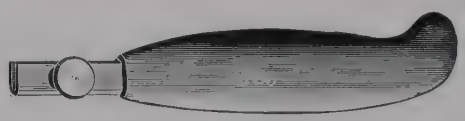


FIG. 13.—Universal handle to fit Killian's tubes.

to be had in the shops vary from 7 to 9 mm. in diameter and 14 to 52 cm. long. For esophagoscopy the sizes are from 11 to 13 mm. in diameter, and from 19 to 52 cm. long. Including both esophagoscopes and bronchoscopes 18 sizes are listed, besides the 6 tubular spatulæ. All of these are not essential, but for the best work and to be prepared to meet all emergencies, the largest possible assortment should be on hand, so that the tube of shortest length and largest diameter possible may be used, for the technical difficulties vary inversely to the size,

Killian uses the Kirstein headlamp for illumination. Von Schrötter designed a bronchoscope (Fig. 14) the chief advantage of which is that the tubes fit in a universal handle, so that after passing a second tube through the first, the handle may be removed from the first and attached to the second and thus only one handle is in use at a time.

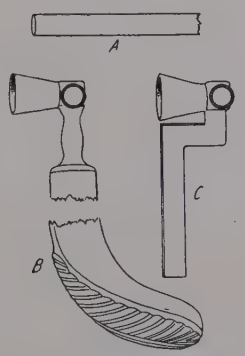


FIG. 14.—von Schrötter's bronchoscope.
A. Bronchoscopic tube. B. Detachable handle, which can be removed, leaving only the cylindrical part of the tube and attached to a second tube passed through the first.

Einhorn's esophagoscope (Fig. 15) consists of a straight tube without lip or ring or thickening at the distal end. In the wall of the tube is made a small auxiliary tube in which a light carrier is inserted, carrying the light to the distal end of the instrument. A mandrin locked by a pin is fitted, presenting a conical end for insertion.

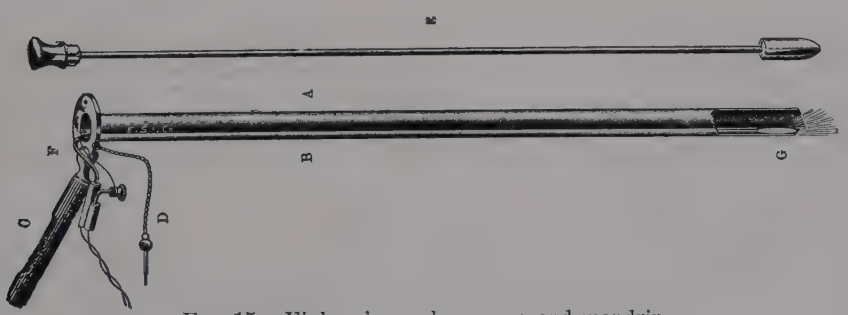


FIG. 15.—Einhorn's esophagoscope and mandrin.

Ingals uses a Killian tube in which he inserts a little lamp on a light carrier (Fig. 16), removing the light carrier before he inserts a mop or a forceps. The light being removed, the forceps are inserted, and the foreign body or specimen is seized by the sense of touch and the memory

of its position, the depth of insertion being known by having a previously placed mark, as by a rubber band, on the forceps shank, showing the length of the particular tube used.

The author's tubes (Fig. 17) are illuminated by a small "cold" lamp carried down to the extremity by a light carrier. The chief advantages of this form of illumination are these:

1. The light being in the tube is always illuminating the object, regardless of the movements of patient or operator.

For this reason, prolonged practice, as with the headlamps and unil-

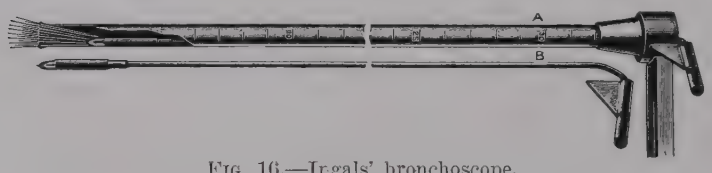


FIG. 16.—Ingals' bronchoscope.
A. Killian tube. B. Ingals' light carrier.

luminated tubes, is not necessary. True, the lamp occasionally gets smeared with blood, but it requires no more time to withdraw the light carrier and clean the lamp than it does to clean off the mirror or lenses of a headlamp which are bedaubed every time the patient coughs, and when thus bedaubed the light is dimmed. The constant readjustment of a headlamp consumes much time, as each time a piece of sterile gauze must be picked up to handle it with in order not to infect the hands.

2. There is no urgent need of selecting the shortest possible tube. The illumination is as good and the view as good through an 80 cm. gas-

FIG. 17. Author's bronchoscope, esophagoscope and gastroscope.

troscope as through a tube of one-fourth this length, For this reason, lower tracheo-bronchoscopy, with the necessity of tracheotomy, is less often required.

3. A great advantage is the obliquity of the light, due to the location of the lamp at one side of the orifice of the tube. Every photographer knows that light from back of the camera makes a flat picture, and every opthalmologist knows that details of corneal lesions, invisible with direct light, show up plainly with oblique illumination. The darker shades of red do not throw back rays strongly, so that in case of a long tube, with

the light at one end and a dark red object at the other, the light traveling twice the tubal length, the greatest skill and the utmost perfection of every detail of apparatus are absolutely essential for results.

4. A small bubble or mass of secretion, or an instrument introduced into the tube does not cut off any light as the light is beyond.

These points make it possible for the surgeon to do good work with these tubes without the long arduous preliminary practice necessary with the headlight and unilluminated tube, though these have other advantages once the skill is acquired, especially in cases where large and short tubes can be used. Each tube is fitted with its own handle which is a great saving of time, as compared to attaching a handle every time a tube of different size is inserted.

The tubes for general use are fitted with an auxiliary drainage canal which maintains a dry, clean condition at the distal end of the tube. Occasionally a tube is needed without this auxiliary drainage, but only

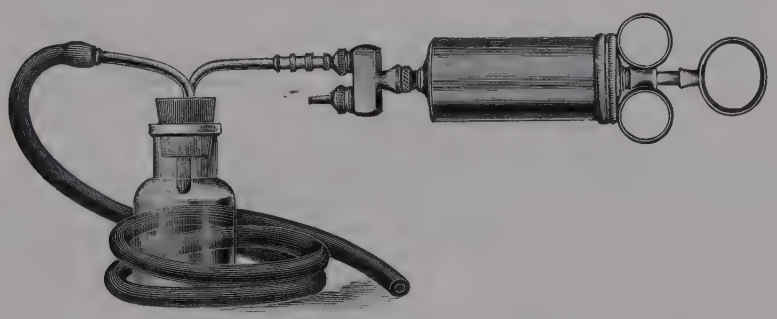


FIG. 18.—Author's secretion-aspirator.

rarely, as in case of passing a narrow stricture. The secretion is pumped out by the negative pressure maintained in the bottle with the aspirating syringe (Fig. 18), the rubber tubing connected with the bottle being slipped over the outlet of the drainage canal. Should the drainage canal become obstructed, which very rarely happens, an extra drainage tube is run in and out as needed, being connectable to the same aspirator. These extra drainage tubes are useful for blowing in medicaments or bismuth oxide for Roentgen ray localization. For bronchoscopy drainage is not often necessary.

ACCESSORY INSTRUMENTS.

Forceps. The forceps of Coolidge (Fig. 19) are exceedingly satisfactory. The tube is pushed over the jaws by a trigger action and the large handle will be very convenient to most operators. Starck's forceps (Fig. 11) are actuated by pushing a thumb button and are good.

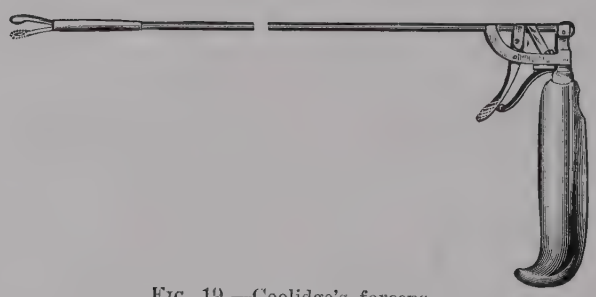


FIG. 19.—Coolidge's forceps.

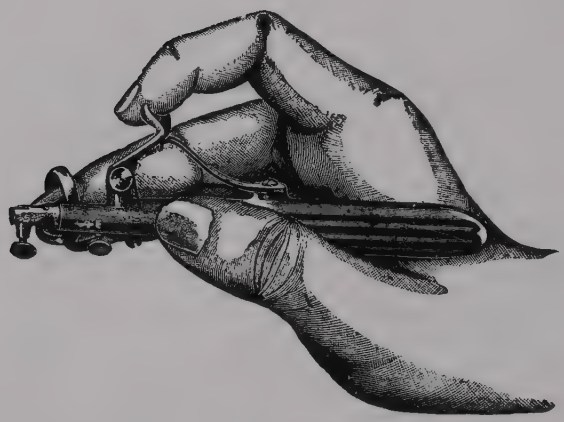


FIG. 20.—Killian's forceps and manner of holding it.

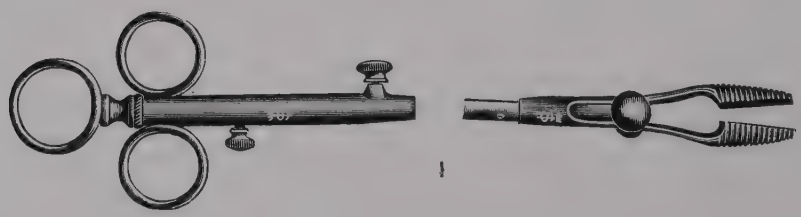


FIG. 21.—Killian's stronger forceps and various jaws, the threaded one being an expanding form for the extraction of hollow foreign bodies.

Killian's forceps (Fig. 20) are made in two styles of mechanism and will be found to do their work perfectly. They are exceedingly convenient to those accustomed to the finger-lever action of Dr. Morrell Mackenzie. A stronger pattern is shown in Fig. 21.

FIG. 22.—Author's forceps.

The author's preference is for the light, convenient, ringed handle (Fig. 22) we are all so much accustomed to manipulate in the hemostat. The tube is pushed over the jaws, the jaws are not drawn into the tube,

FIG. 23.—Author's forceps, curved jaws.

thus they do not retreat from their bite. As with all tube forceps, the strength of grip of this instrument is astonishing. Different lengths of canulæ and differently formed jaws are made to fit one handle. The

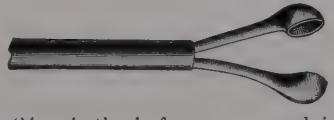


FIG. 24.—Author's forceps, cupped jaws.

form shown in Figure 23 is for going down alongside a pin or needle and grasping it sidewise, or reaching around a turn or bend, or sidewise past the end of the tube. These are also made with cupped extremities like Fig. 24, for the biting out of a specimen laterally from a wall. Either cupped or serrated they will be found exceedingly useful for biting off a pa-

pilloma or other neoplasm from the anterior commissure of the larynx, and similar purposes, as will also the punch forceps (Fig. 25).

Cotton carriers with roughened ends are too uncertain. It is annoying to have the dossil slip off, and still more so is the delay occasionally necessary for a prolonged search for it. Mikulicz has devised a very ingenious claw end to hold the cotton. Coolidge uses the most comfortably

FIG. 25.—Author's forceps. Punch jaws for excision of a specimen. The lower instrument is a tent carrier to work in forceps handle.

safe device (Fig. 26). The slip collar screws down on the spring jaws so that they cannot lose the dossil.

The author uses these exclusively for bronchoscopic work, though for the esophagus and stomach where there is no risk from, or delay in removing, the lost mop, the author uses the simple slide which does not screw, small gauze sponges being used instead of cotton, which is prone

FIG. 26.—Coolidge's cotton holder.

to leave threads that interfere with vision. About a dozen carriers are needful for rapid work.

Of the other accessory instruments, various hooks, probes, etc., are useful.

Mosher has devised a most ingenious *safety pin closer* (Fig. 27). It consists of a ring which is passed down below the open pin; then the pin

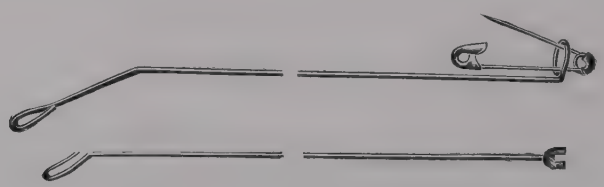


FIG. 27.—Mosher's safety pin closer.

is pushed in spring-end first by the little pronged instrument. To facilitate passing the ring below the pin, the author has arranged a stem that permits of introducing the instrument with the ring in the same plane as the stem. After the ring has passed the pin, moving the handle turns the ring to a right angle with the stem. (Fig. 28.)

For endolaryngeal surgery, such as the incision of edematous masses,

division of stenotic webs, opening of abscesses, and similar work it will be found necessary to have at least one knife. (Fig. 29.)

A mouth gag is a most important accessory. Ferguson's (Fig. 30) has given the author most satisfaction. A long cleaning wire for the

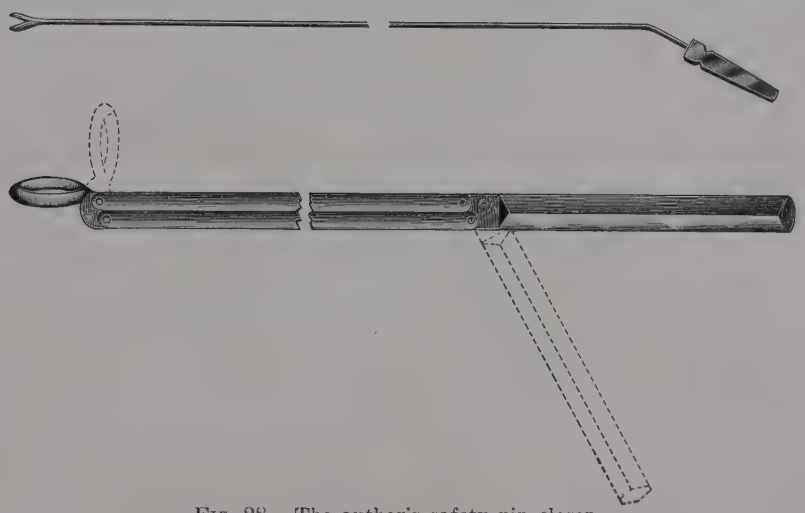


FIG. 28.—The author's safety pin closer.

canals, extra lamps, sterile vaseline, small gauze strips about 4x6 cm. in size and folded into sponges, a steel centimeter rule and battery complete the outfit.

Commercial lighting circuits should never be used for lighting the

FIG. 29.—Author's laryngeal knife.

lamps. All rheostats have one live side which may be "grounded" through the patient, involving great danger, even if of no more than 110 volts pressure, on account of the good contact with the moist mucosa, throughout the length of the tube. Dry batteries (Fig. 31) involve no risk what-

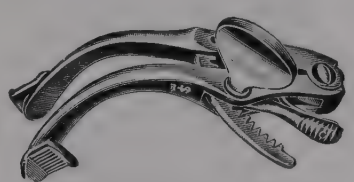


FIG. 30.—Ferguson's mouth gag.

ever and with intelligent care are perfectly satisfactory. The box should have a rheostat for regulation of the current. If much work is to be done a storage battery (Fig. 32) will be found convenient.

If the operator does not wear glasses habitually, it will be necessary to have spectacles with plain eyes of large size for the prevention of infec-

FIG. 31.—Eight-cell dry battery for endoscopy.

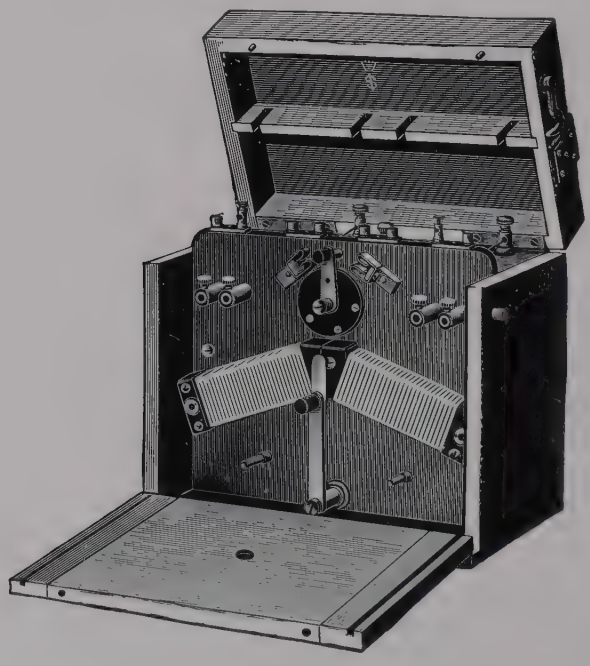


FIG. 32.—Four-cell storage battery for endoscopy.

tion from coughed out secretions, which shoot out like projectiles from the tubes.

A list of instruments is here appended for convenience:

LIST OF INSTRUMENTS.

TUBES.

The author's tubes are made in the following sizes:

10	mm. x 53	cm.	esophagoscope	for	adults.
7	" x 45	"	"	"	children.
7	" x 40	"	bronchoscope	"	adults.
8	" x 20	"	tracheoscope	"	adults.
5	" x 14	"	"	"	children.
5	" x 30	"	bronchoscope	"	adults.
5	" x 45	"	"	"	children.
12	" x 17	"	tubular speculum.		
12	" x 17	"	separable "	for	adults.
10	" x 70	"	gastroscope	for	adults.

If rigid economy must be practiced, much good work can be done with a 7 mm. x 45 cm. esophagoscope, a 5 mm. x 30 cm. bronchoscope, and a 12 mm. x 17 cm. separable speculum. The 7 mm. x 45 cm. esophagoscope can be used in the adult trachea and main bronchi, but if used in the latter, the absence of lateral openings must be remembered. Lateral openings are a disadvantage in an esophagoscope. He who expects to work to the best advantage with any and every case encountered will need the entire set. For bronchoscopy tubes with drainage are not often needed.

The diameters of the tubes as here given are of the cylindrical tubes before the canals are made in the walls. These canals bulge outward slightly, thus increasing one diameter, though this need not be taken into account as the resiliency of the passages more than compensates for it.

Killian's tubes are made in the following sizes:

For	bronchoscopy,	adults	9 mm.	x 18	cm.
"	"	"	9 "	x 25	"
"	"	"	9 "	x 35	"
"	"	"	9 "	x 41	"
"	"	children	7 "	x 13	"
"	"	"	7 "	x 18	"
"	"	"	7 "	x 23	"
"	"	"	7 "	x 28	"
"	"	"	7 "	x 35	"
"	esophagoscopy	adults	11 "	x 19	"
"	"	"	11 "	x 32	"
"	"	"	11 "	x 45	"
"	"	"	11 "	x 52	"
"	"	"	13 "	x 19	"
"	"	"	13 "	x 24	"
"	"	"	13 "	x 32	"
"	"	"	13 "	x 42	"
"	"	"	13 "	x 52	"

For esophagoscopy in children the 9 mm. bronchoscopes are used.

One universal handle for all tubes.

Tube spatulæ, three sizes.

Tube spatulæ, split, three sizes.

The following list of accessories will be found to contain the essentials:

ACCESSORIES.

Aspirator and tubing.
3 mm. x 60 mm. extra drainage tube.
3 " x 40 " " " "
4 " x 84 " " " "
1 forceps 25 cm. canula and 4 jaws.
1 " 35 " " " 4 "
1 " 60 " " " 4 "
1 " 84 " " " 4 "
½ doz. sponge holders 25 cm. long.
½ " " " 60 " "
1 " " " 84 " "
1 hook and probe 25 cm. long.
1 " " 60 " "
1 " " 84 " "
1 Lister-Killian hook 25 cm. long.
1 " " " 60 " "
1 " " " 84 " "
1 safety pin closer, 5 mm. ring, 50 cm. long.
1 " " " 10 " " 60 " "
1 Sajous laryngeal sponge forceps. (curved)
1 Laryngeal knife.
1 " cautery electrode and cord.
1 " galvanic electrode (monopolar) and cord.
½ doz. extra lamps.
2 wires for cleaning canals.
1 sterilizing tube for packing sterilized extra lamps.
Eye glasses for the protection of operator's eyes.
1 double bronchoscopic battery and conducting cords.
1 extra battery cord.

CHAPTER III.

Acquiring Skill.

As bronchoscopy with the average laryngologist or surgeon is relatively a rare procedure, some preliminary practice is advisable. If Killian tubes with the Kirstein headlight are used considerable preliminary training will be necessary to keep the light properly directed down the tube, and the general physician or surgeon, who has had no experience whatever with even the ordinary head mirror, will find that long preliminary practice is necessary in order to see anything. With the distally illuminated tubes anyone can see clearly. The author has frequently had physicians totally unfamiliar with tube work, discuss appearances at their first examination in a way that revealed the fact that they had obtained good clear views. Nevertheless, some practice is, of course, necessary. Endoscopy is in no case like looking through an opera glass. Many details require attention. Lights are to be cleaned and readjusted, secretions to be contended with, cough and reflexes to be combatted.

The first step should be the technical management of the miniature electric lights and the batteries. If possible, this should be acquired by instruction. If not possible, the details may be worked out by experiment. After burning out a few lamps, the current strength they will stand is soon learned. If too strong it will shorten the life of the lamp even if it does not immediately burn it out. All lamps, whether used in tubes or on headlamps, must be adjusted by watching the filament. It will never do to start using the tube and then run up the rheostat until the operator thinks he is getting enough light on the object. This will mean no end of trouble. Every lamp will stand just so much, and no more. This amount gives what is called full illumination. It is not easy to describe, further than to say that it is the point where the filament seems to grow thicker and turn white, just beginning to lose the yellow. When first commencing to glow, it is red. As the rheostat is run up, it turns to yellow, and then to white. When just commencing to turn white is the point of full illumination.

If pushed to intense dazzling whiteness, it is overilluminated and will soon burn out; while if only yellow, with the filament plainly visible, it is underilluminated and useless. Until this is thoroughly mastered, it is useless to attempt endoscopy. Many utter failures have been due to rushing into endoscopy on the living without a full mastery of the purely mechanical details of the instruments.

Some practical experience in the location of electrical troubles is exceedingly useful and can only be acquired by practical experience with electrical apparatus. An automobile ignition experience may help. A skillful experienced operator will quickly locate the cause of "no light" where the inexperienced will give up in despair. All electrical apparatus turned out for medical work, including that for endoscopy is too flimsy. The wires are too fine, the switches and rheostats too delicate. Of course, even if perfect in construction, wear and also damage by transportation, rough handling, sterilization, and other things will cause broken circuits, short circuits, and "no light." The best way is to have a definite routine for locating trouble. The following order is a good one:

1. See if your switch is on and the rheostat where it ought to be, pressing the levers to see if they have sprung away from contact.

2. Test all contacts and connections by screwing home the lamp, twisting the bayonet catch, screwing down the thumb nuts on the binding posts.

3. Next try a new light carrier that lighted up properly before. If this lights up, the trouble is in the previously used light carrier or lamp, which of the two being quickly located by trying a new lamp. If the light carrier which worked perfectly before, fails to light up, try a new cord, or if this is not at hand, close the circuit from one binding post to the other through the light carrier.

If at any time, the light flashes on again, note where you were touching the apparatus at the time, as there is likely a loose connection at the point, brought into contact by your touch.

These details are soon learned and are necessary with any endoscopic apparatus, unless an electrician be available in the operating room.

The location of "no light" troubles with the Kirstein headlamp is much the same. First, see if the current is on by turning on one of the room illuminating lamps. Then test the Kirstein lamp to see if it is screwed home, or, if the glass looks blackened on its interior surface, try a new one. Next, test the cord as before described, then the switch, then the binding posts and rheostat. Usually the commercial lighting circuit is used, and rheostats for this purpose as made at the present day are flimsy and subject to constant disorder. Two or more are necessary as at least one will be always at the factory for repairs. There is no need for this to

be the case, but such seems to be the condition of medico-electrical manufacturing to-day. Doubtless there would be less trouble, too, if physicians were better skilled in electrical mechanics.

After the details of batteries and lights have been mastered some familiarity with the manipulations may be gained from tubal examinations of the interior of the clenched fist, pushing the tube down through it from the upper (radial) side.

The rubber manikin of Killian (Fig. 33) is very useful for practice, being ingeniously designed to simulate actual obstacles to the introduction

FIG. 33.—Killian's manikin for practicing bronchoscopy and esophagoscopy.

of a tube through the natural passages. The dog offers a convenient animal subject for practice. Chloretone hypodermatically in doses of 1 gramme is a convenient anesthetic for the dog. The author's preference is for scopolamine gr. 1/100 (0.00065 gm.) with morphin gr. 1/2 (0.0324 gm.) given hypodermatically one hour before, and repeated, if there be no signs of oncoming stupor, twenty minutes before the time for practice.

Much available material is wasted about the average clinic. Cases of goitre that complain of dyspnoea, justify tracheoscopy, and any case of goitre which by its size demands operation should be tracheoscopized for the information yielded. Cases complaining of difficulty in swallowing are neglected or sent to the general medical or gastro-enterologic clinic, when in reality it is the plain duty of the laryngologist to find out by direct laryngoscopy, and by esophagoscopy *why* they cannot swallow. Patients wearing tracheal canulæ would be the better for a tracheoscopic watch upon their endotracheal condition. Mucosal inflammations and ulcerations, perichrondrial and chondrial diseases could be detected and cured. All this material is at the present writing wasted in all the clinics of this country, to say nothing of the neglect of the patients' best interests.

CHAPTER IV.

Technic of Direct Laryngoscopy and Tracheobronchoscopy.

General Considerations.

Asepsis. It cannot be too strongly emphasized that the strictest details of aseptic technic must be followed out. This will limit infective risks to those organisms already present in the mucosa. If this be not done, sooner or later, the operator will have upon his conscience the burden of having inoculated a fellow creature with syphilis, diphtheria, erysipelas, tuberculosis or other infection.

In regard to the field of operation, absolute asepsis is impossible, but the mouth, the most septic portion of the tract, can be put in a relatively clean condition.

A definite routine position of all tables, instruments, batteries, assistants and nurses should be followed, otherwise all is confusion, which is not conducive to good work. Quiet, orderly procedure is essential. Sterile caps should be worn as well as gowns, to prevent infection of instruments in passing them to and fro, especially the long instruments, particularly when an assistant or the operator stoops, kneels or sits.

The patient is clothed in a sterile gown if the sitting posture is used; or covered with the usual sterile sheet and towels if examined in dorsal decubitus. Either way he should wear a sterile rubber cap pulled well down over the ears.

Sterilization. All instruments except the light carriers, battery cords and aspirator can be boiled. The light carriers should be immersed in alcohol before using and a stock of lamps already sterilized should be packed in glass sterilizing tubes. The battery cords are rubber covered so they can be wiped with mercuric bichloride solution. The aspirator is immersed in 5 per cent. carbolic acid solution, which is also pumped through it a number of times. It is then rinsed in sterile water.

If, during the course of an upper bronchoscopy, it is decided to do a lower bronchoscopy, everything should be resterilized before opening the trachea, provided there is time. Sterile tracheotomy instruments should be at hand on a separate table where they will not get soiled while working with the bronchoscopes through the mouth, and where they are ready for immediate use. If, as will occasionally happen, an immediate tracheotomy is required, it is an advantage to have an assistant who has not been contaminated with the mouth, or the instruments used therein, to stab the trachea. In any case there will be ample time to resterilize all tracheo-bronchoscopic instruments before introducing them into the trachea, and it is utterly unjustifiable except in dire emergency to introduce through a tracheotomy wound, the instruments soiled in the mouth. It may be argued that in upper bronchoscopy the tubes are introduced through the mouth, but they are introduced through a split spatula and no great amount of infective material need be carried downward. Besides, one great advantage of lower bronchoscopy is its asepsis, and this advantage will be lost if instruments infected in the mouth be used without resterilization.

During an examination the small lights require cleansing frequently, the light carrier being withdrawn for the purpose. With trained help this requires but a moment. Occasionally it will be found that the current requirements of the lamps vary, and a little readjustment of the rheostat is necessary for a fresh lamp. For rapid work, it is imperatively necessary to have a trained assistant who is thoroughly familiar with all the apparatus, and also a nurse who is trained to keep the lamps and tubes clean and in good order while working, so that the operator has nothing to do but to observe, while armed sponge holders, forceps, probes, hooks, fresh light carriers with lights properly illuminated are handed to him as called for.

A stock of extra miniature lamps should be kept sterile, packed in glass sterilizing tubes with a wad of cotton between each lamp, so that a single extra lamp can be taken out when needed without infecting the others more deeply placed. In this way the extra lamps are always ready and never need sterilizing but the once.

Unilluminated tubes should never be boiled as boiling soon dulls the brilliancy of their interior polish.

Preparation of the patient. Foreign body cases will often be dealt with without preparation of the patient. Where there is time, as there usually is in most other cases, and in many foreign body cases, it is best to insist upon proper preparation. A purge should be given, and no food allowed for 6 hours for tracheo-bronchoscopy, 8 hours for esophagoscopy and 12 hours for gastroscopy. Even in direct laryngoscopy the presence of the instrument in the pharynx may excite vomiting if there be food

in the stomach. The possible need for general anesthesia also renders fasting necessary in a locally anesthetized case. If the patient has just eaten, and delay is inadvisable, lavage of the stomach is called for.

The nearest approach to oral asepsis is imperative. Whenever practicable the teeth should be put in the best of condition by the dentist.

The patient is then directed to brush his teeth with soap and chalk and to rinse his mouth every two hours with thirty per cent alcohol. As shown recently by Dr. A. Wadsworth, alcohol is the most efficient oral antiseptic. A more eligible preparation, as advocated by Wadsworth, is made by adding sodium bicarbonate and chloride in normal salt proportions and spirits of chloroform and oil of wintergreen as flavoring to the alcohol.

The patient should wash his face thoroughly with soap and water, being particularly thorough with beard or mustache if he have these; and he should rinse first with water and then with 1:1000 perchloride of mercury solution.

DIRECT LARYNGOSCOPY.

Anesthesia. For ordinary routine work either in the consulting room or in the operating room, local anesthesia is sufficient. A 4 per cent

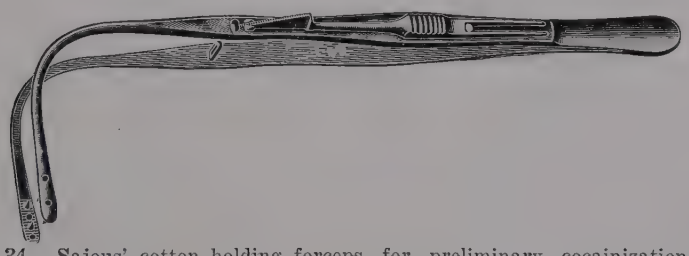


FIG. 34.—Sajous' cotton holding forceps for preliminary cocainization of the larynx and pharynx.

solution of cocain is applied with a mop of cotton held in the Sajous forceps (Fig. 34). After waiting a few moments, the laryngeal speculum (Fig. 6) is introduced until the epiglottis appears and a more accurate application is made to the epiglottis and all tissues in its neighborhood. Then the instrument is passed posteriorly to the epiglottis, bringing into view the interior of the larynx and the introitus esophagi, which are swept over with a 20 per cent solution. Cotton mops may be used for this.

For operative work, where there is no dyspnoea, a general anesthetic should be used, as the relaxation and absence of tetanic reflexes renders the examination very much easier. It is not painful, though a spectator would not believe this, as in many instances the patient looks as if he were choking to death. Cocain must be used cautiously in children.

If a general anesthetic be used, chloroform is preferable; being continued, after the examination starts, by a gauze sponge held with a hemostat and saturated with chloroform. This is held over the mouth and nostrils, or, if the patient has been tracheotomized, over the tracheotomy wound.

Direct laryngoscopy. Patient sitting. For ordinary routine direct laryngoscopy in the consulting room, the patient sits upon a low stool, the assistant sits on a higher stool or stands behind the patient and holds the gag and the head and keeps the lip out of the way, so that it will not be pinched between the instrument and the upper teeth. It is possible to hold even an unruly child by using the following method: The nurse holds the

FIG. 35.—Direct laryngoscopy. Patient sitting.

child's knees between her own, crossing her arms in front of the child and catching opposite hands with the child. The head on her shoulder is held by an assistant. Another way is to wrap the child in a sheet. The author does not advise working thus. Dorsal decubitus is better with unruly children, and the author prefers it under almost all conditions.

In the operating room the posture of the patient and the positions of the second assistant and the nurse are as shown in Figs. 35 and 36. The operator in the position shown in Fig. 37. Forceps and other instruments are handed as called for.

The duties of the first assistant are to hand all instruments to the operator in the position for insertion with their axes corresponding to that of

the tube. He should do this with his right hand while in his left he holds a half dozen or more sponge-holders, which are handed as needed to the patient sits on a low stool, the second assistant sits on a higher stool back of the patient. The first assistant and the nurse are to the right of the operator with the instrument table between them. (These are removed in in the cut so as not to hide the positions, etc.) The battery is on a low strong table to the left. It is covered with sterile towels on which the cord may be laid when not in use. The knob of the rheostat can be felt through the towel and moved as needed.

The duties of the nurse are to stand back of the table (the first assistant being in front) to refill the sponge-holders as they are laid down on the table, soiled, by the first assistant. As refilled she lays them in position so that the first assistant can pick them up conveniently. If an aspirator

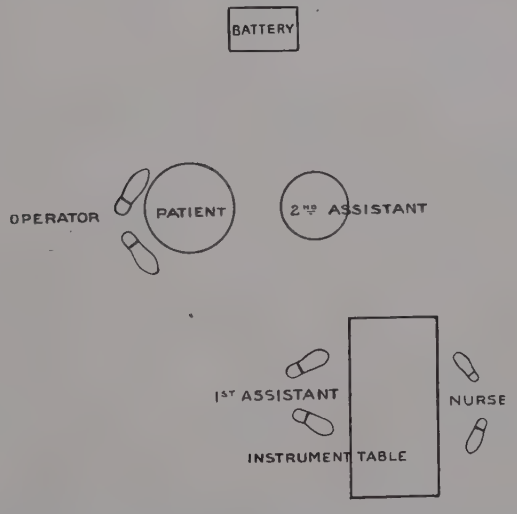


FIG. 36.—Direct laryngoscopy. Patient sitting. Diagram of positions of persons and things. Table should be a little nearer the operator.

is used she may work this, or it may be done by the second nurse. If but one nurse is to be had, a good supply of sponge-holders is needed.

In looking at Fig. 37 the table would be the foreground, with the nurse to the right, and the first assistant to the left, as seen in the diagram Fig. 36.

The duties of the second assistant are extremely important. He must hold the patient's head bent backward, with the trunk, and especially the neck pushed forward, the bend being as much as possible in the region of the axis and adjacent cervical vertebræ. At the same time he holds the mouth widely open with the gag, and in a case of a sitting patient, with the forefinger he keeps the patient's upper lip away from the upper teeth.

He should realize the importance of his duties, and that a cut upper lip means the most reprehensible carelessness upon his part.

All of the details as here given are not absolutely necessary for the brief examination in the consulting room; but for more prolonged examinations, removal of foreign bodies, and certainly for all operative procedures attention to all the details given is absolutely essential, as already mentioned, for good work.

Using the laryngeal speculum. The light on head lamp or light carrier having been adjusted to the proper brilliancy, and the field being anesthetized, the tubular speculum is inserted until the epiglottis appears in view. The flat end of the tube is passed behind the epiglottis about a

FIG. 37.—Lower tracheo-bronchoscopy. Patient sitting.

centimeter, and now comes the only point where difficulty in the manipulation is encountered. Once this knack is acquired, no difficulty will be met with. The epiglottis must be pushed forward tightly against the base of the tongue, which, with the tissues attached to the hyoid bone, must be forcibly pushed forward out of the line of vision. This pushing is done with the spatular extremity, the direction of motion being shown schematically in Fig. 38. The instrument is given a forward motion of the tip by an upward and backward motion of the handle, the pivotal point being at the junction of handle and tube. By this it is not meant that the tube rests on the upper teeth. This is the first and most serious error made by

the inexperienced. It is utterly impossible to get a good view of the larynx if the upper teeth are used as a fulcrum to pry the mouth open and the hyoid tissues forward, and the strength required is painfully great for both patient and operator.

Another error frequently committed by the inexperienced is the insertion of the speculum too deeply, so that it gets behind the cricoid cartilage. This is evidenced by interference with the patient's breathing, by the opening up of the upper end of the esophagus to view and resistance to the forward pressure of the tip of the instrument. Under these circumstances, when the speculum is withdrawn slightly the "brassy" tubular respiratory sound denotes the right place. One soon learns to tell by the sound when tubes are at the laryngeal orifice.

Upper tracheo-bronchoscopy. Sitting posture. If desired, as in severe dyspnoea, the bronchoscope may be passed with the patient seated.

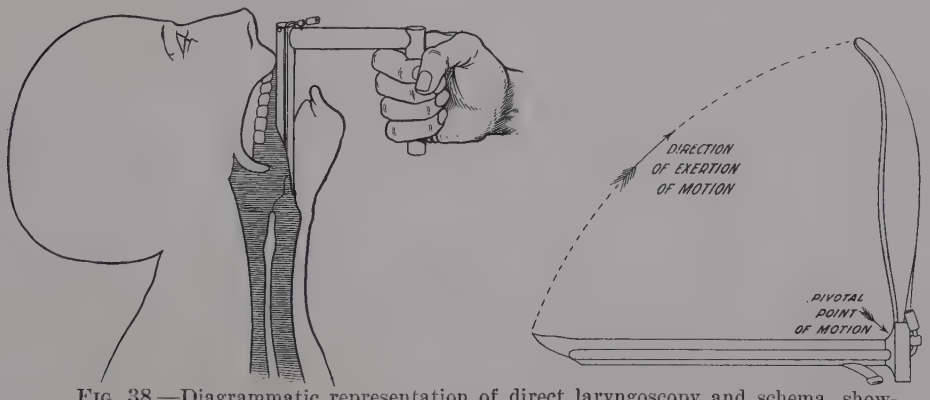


FIG 38.—Diagrammatic representation of direct laryngoscopy and schema, showing direction of force applied in using the tubular speculum and separable spatula.

The split tubular speculum is used and the bronchoscope passed as shown in Fig. 39, which, however, shows the first assistant in the wrong position, the correct one being as in Figs. 36 and 37. The technic is the same as described for the recumbent posture. The author prefers the latter posture for bronchoscopy and he would tracheotomize patients too dyspnoeic to lie down without it Should tracheotomy be demanded, it is an advantage for the patient to be already recumbent upon the table. When a general anesthetic is used recumbency is imperative. Fig. 39 shows left upper bronchoscopy, the split tubular spatula in the right buccal angle, the bronchoscope passed through the tubular spatula which has not yet been removed. The second assistant holds the gag in the right side of the patient's mouth, while with his left forefinger he elevates the patient's upper lip at the left side (removed when the photograph was taken so as not to hide the instruments).

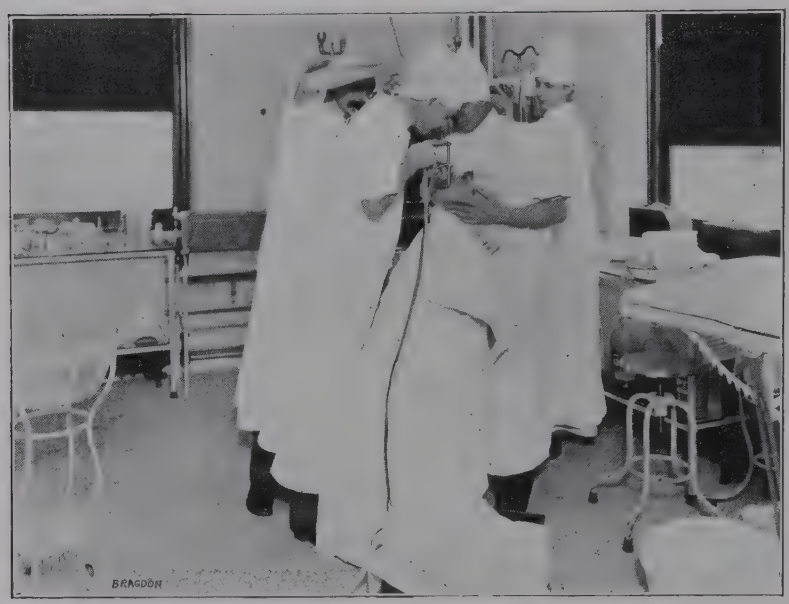


FIG. 39.—Left upper tracheo-bronschoscopy. Patient sitting. First assistant's position should be as shown in Figs. 36 and 37.

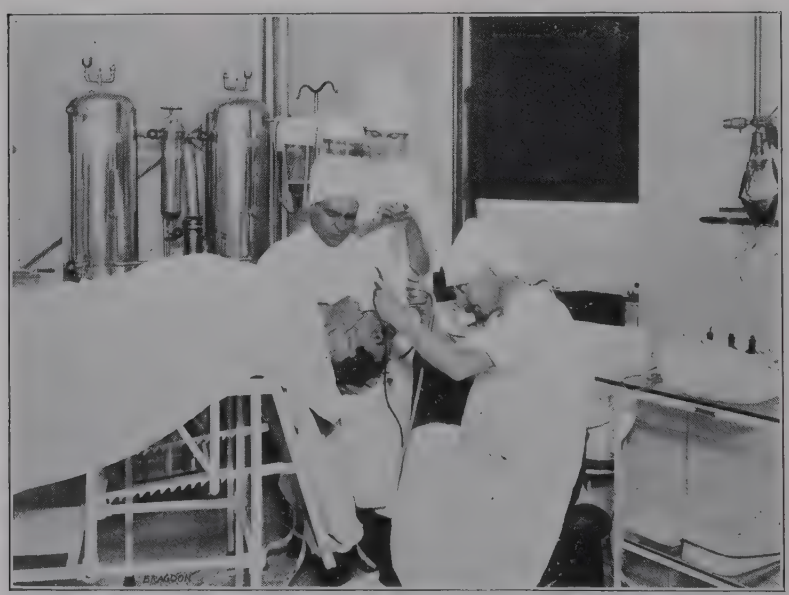


FIG. 40.—Left upper tracheo-bronchoscopy, showing the introduction of bronchoscope through the separable speculum.

Lower tracheo-bronchoscopy. Sitting posture. (Fig. 37.) This also is not advisable for prolonged work, but it is perfectly feasible. It is a great convenience and should always be used in one class of cases: namely, walking cases wearing tracheal canulæ. A close watch should be kept on these cases, for granulations, ulcers, et cetera, in the trachea. This is easily and quickly done with a short tracheoscope, which is much better than any form of dilator for even the deeper parts of the wound, while for the trachea itself it is the only way that ulcers, granulations, etc., may be treated and cicatrices and stenotic webs prevented. Should dyspnoea supervene when the tracheal canula is removed, a quick insertion of the tracheoscope will give instant relief.

If previously tracheotomized the bronchi may be examined in this way.

Of course in patients just tracheotomized, the recumbent posture is used, and the author prefers recumbency in all cases,

Direct laryngoscopy, dorsal decubitus. The chief differences between direct laryngoscopy with the patient in the sitting and dorsally decumbent positions, are in the arrangement of nurses, assistants and operating room detail and in the manner of grasping the tubular speculum. The operating room arrangement is the same as described in the following pages under "Upper tracheo-bronchoscopy."

The manner of making pressure with the tube does not differ so far as the relation of tube to the patient's anatomy is concerned. The tubular spatula is grasped firmly in the operator's left hand, as shown in Fig. 40, and the motion shown in the schema (Fig. 38) is imparted to it, as if to lift the patient off the table with the *tip* of the speculum, or as if to force the epiglottis out between the hyoid bone and the thyroid cartilage with the tip of the speculum. Care must be taken to avoid mistaking the inferior constrictor, or a glosso-epiglottic fold for the epiglottis.

UPPER TRACHEO-BRONCHOSCOPY, DORSAL DECUBITUS.

Posture and other details. The patient lies upon an operating table, the foot of which is 15 inches lower than the head. The table shown in the figure 40 was designed by the author for this and other throat work. It is pivoted horizontally in the center so that it balances and no matter how heavy the patient, it is easily raised or lowered. The headboard is only dropped after the second assistant is ready to support the head. Most tables have a dropping headboard of this kind, but if not the patient must be moved until his shoulders slightly overhang the edge of the table. When everything is ready, lights regulated, tubes greased, sponge-holders armed, assistants in position, the headboard is dropped and the patient's head is in the air free to move in every direction (Fig. 40) under the con-

trol of the second assistant, who (in left upper bronchoscopy) sits upon a high stool on the right side of the patient, his right arm back of the patient's neck, holding the gag in the left side of the patient's mouth, while his left hand supports and controls the patient's head from underneath, the hand resting upon his (the assistant's) knee, which is elevated to the proper height by a footstool or by crossing one knee over the other, depending upon the height of the table. In this position the second assistant can do his duty without undue fatigue during a prolonged search or operation. As before stated, the second assistant is the most important factor in the work. His work is fatiguing and he should be made as comfortable as possible. The holding of the gag is a thing that few men ever do correctly. The best gag is Ferguson's, and it must be placed on the canine or lateral incisor teeth, not back on the molars, where it is sure to slip. It

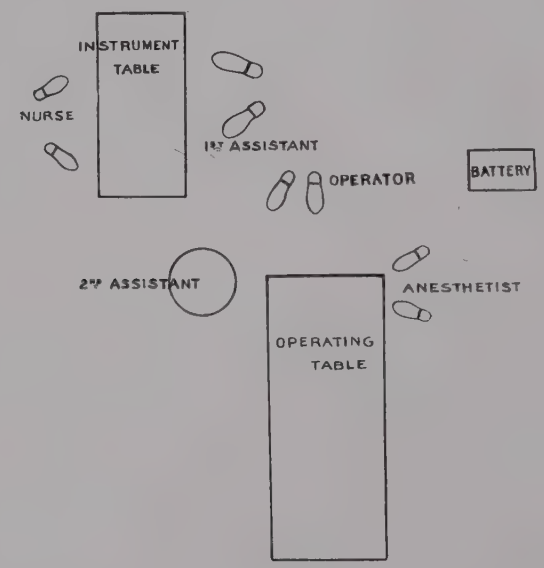


FIG. 41.—Direct laryngoscopy, tracheo-bronchoscopy, esophagoscopy, gastroscopy. Patient recumbent.

is placed on the side of the mouth opposite to that through which the tube is passed.

In order to take the photograph the operating room arrangement was disturbed. It is shown diagrammatically in Fig. 41, and it is very essential that this arrangement be strictly followed, otherwise all will be chaos with the long instruments needed in upper tracheo-bronchoscopy. The duty of the first assistant is to pass instruments, always in position for insertion. The nurse works the aspirator, refills sponge-holders, and cleans the instruments.

The anesthetist stands upon the left side of the patient and whether giving the anesthetic or not, must keep the lip of the patient away from the edge of the teeth with the left forefinger. This duty cannot be performed by the second assistant with a recumbent patient.

Anesthesia. The examination of the bronchi is perfectly feasible under cocain anesthesia, especially if a large dose of morphin be given; the morphin adding courage, rather than anesthesia; but except in dyspnoeic cases the author prefers chloroform, and in any case he considers morphin, with its prolonged abolition of the cough reflex unsafe. The cough reflex is the watch-guard of the lungs, by which infective or deleterious materials are removed.

Cocain is first applied as described when writing of direct laryngoscopy.

After the glottis is passed, the tracheal and bronchial mucosæ are anesthetized a portion at a time in stages as the tube is advanced, using cotton, or as the author prefers, gauze, sponges.

Chloroform is given in the usual way on an Esmarch inhaler until the patient is fully under its influence. Then the split spatula is inserted and the larynx is mopped with 20 per cent cocain solution. It is often possible to anesthetize the trachea also thus through the tube spatula with a long applicator. After the bronchoscope is passed the cocain solution is applied to the tracheal and bronchial mucosæ from time to time. In this way a minimum amount of chloroform is needed and the cardiac stimulant effect of the cocain is a safeguard of value.

After the bronchoscope is passed the chloroform is dropped upon a gauze sponge held intermittently in front of the tube, for but little air is taken in past the tube which is clamped in the glottis by the reflex spasm of the adductors.

The preliminary use of atropine to lessen secretion as suggested by Ingals is a good, safe procedure. It has the additional advantage of protecting the circulation from shock. Adrenalin assists in this and also in lessening the mucosal swelling.

Passing the bronchoscope. The author's first work was done by passing the bronchoscope with the left forefinger as a guide and fulcrum upon which the tube was turned into and through the glottis by a rocking motion. The pilot was in situ and was removed as soon as the glottis was passed. When Killian devised his ingenious split tubular spatula, the simpler method was followed. At present the author uses the split speculum shown in Fig. 7, one battery cord being attached to it and one to the bronchoscope.

The method is briefly as follows: The separable speculum is passed in precisely the same way as is the tubular speculum, as described under

direct laryngoscopy. After the glottic aperture is brought fully into view, the patient, if under local anesthesia, is told to take a deep breath and when the cords separate the well greased bronchoscope without a mandrin, with tubing unattached, is pushed in. After passing the glottis the aspirating tubing is attached if necessary, which it rarely is.

The patient does not always take the deep inspiration at command because the glottis is closed by a spasm of the adductors, due to a reflex from the presence of the instrument. He may be making violent efforts to draw in a deep breath, but cannot do so. Slightly withdrawing the instrument and a quiet reassurance of the patient by the operator usually relaxes the spasm. It is less likely to occur if the larynx is well cocainized.

If a general anesthetic be used, of course the patient cannot be told to take a deep breath; but anyway it is needless, as the rythmic respiratory movements of the cords are watched and the bronchoscope inserted just as they are on their inspiratory abductive excursion. The tube mouth should not touch the cords until it is thrust through.

The split tubular spatula is used in its illuminated form, but the light of the bronchoscope may be used by simply holding it in place within the tubular speculum with the right hand to show when the glottis is exposed to view by the energetic lifting of the split tubular spatula held in the left hand. The operator's eye is held at the bronchoscope, which is then passed by sight.

The latter plan is necessary when a double battery is not used. The mandrin is not used, and the battery cord is attached to the bronchoscope from the beginning. In the first described plan one battery cord is used on the separable speculum, and another cord on the bronchoscope. In either method, after the bronchoscope mouth has passed the larynx, the spatula is separated and removed. (See schema, page 53.)

Once past the glottis, the entire bronchial tree is easily explored.

The left bronchus, which deviates more obtusely from the trachea than the right, is no more difficult to enter with the tube than is the right. The right upper lobe bronchus is perhaps the most difficult.

To explore the right bronchus the tube is moved to the left angle of the mouth, and the head and neck of the patient are moved slightly to the left. The amount of elasticity of the bronchial tree is astonishing.

Care must be taken to see that there is always a free passage for air. As shown by Killian if the bronchus examined is occluded by a foreign body, the other bronchus being shut off by the passage of the tube, will leave the patient without air.

In passing Killian's tubes the Kirstein headlight should be first carefully focused and then adjusted before the eye. Then the tube should be warmed, as, if cold, the polish of the interior of the tube will be dimmed

by the condensation of moisture from the patient's breath, which will seriously interfere with the amount of light that will reach the object at the distal end of the tube. Much of the light that reaches the bottom of the tube is not the direct rays but the rays reflected from wall to wall one or more times in the length of the tube. For this reason, also, the interior of the tubes must be kept cleaned of secretion and blood as thoroughly as possible during the examination.

All tubes, of whatever kind, should be lubricated with vaseline. A jelly lubricant soluble in water is not satisfactory. In the use of the unilluminated tubes particular care should be taken that none is allowed to get upon the interior walls, as this will diminish the illumination of the object. Particular care is necessary to see that a surplus does not get upon the far end of the tube where the withdrawal of the swabs will carry it into the tube.

Another method of passing the unilluminated bronchoscope is with the aid of a catheter-like mandrin which is longer than the tube and projects beyond the tube, acting as a pilot. As soon as the catheter passes the glottis, the tube is pushed on past, also, and then the catheter is quickly withdrawn. Sufficient air passes through the catheter to prevent interruption of respiration.

It may be in some cases advisable to have the tongue drawn forward out of the mouth during the introduction of a tube. The author has not found this necessary except in a few instances, even before the use of the separable spatula. A rocking motion of the tube, throwing the distal end of the tube forward and the proximal end backward, using the end of the left index finger as a fulcrum has always served the author better than drawing out the tongue or pulling it forward with the Kirstein spatula. Much depends upon the operator's training. Those accustomed to intubation will find their index finger the best guide. The separable tube spatula has, however, rendered all other methods difficult by comparison. Thorough mastery of direct laryngoscopy renders bronchoscopy easy.

An absolute essential in the use of unilluminated tubes is the skillful technical management of the headlamp or handlamp. Many of the utter failures to get results with these tubes is due to faulty management of the Kirstein headlamp.

Adjusting the Kirstein headlamp. First the hood (L Fig. 1) should be removed, the mirror (S) and lens cleaned and polished, and then the rheostat run up to the point where full illumination is secured, yet not so high as to burn out the lamp or materially to shorten its life. This point should be learned by demonstration if possible. It may be described as the point where the filament seems to thicken and grow white, beginning to lose the yellowness of its earlier and weaker stage of illumination.

The next step is to focus the rays. The hood (L) should be moved upward and downward until the proper focus is found, which is when the rays are parallel as shown by the disk of light thrown upon the hand held up in front of the light and moved backward and forward. The disk should grow neither larger nor smaller as the hand is moved. Pushing the hood upward diverges the rays, and pulling it downward converges them. If pulled too far downward the rays cross over, which is a disadvantage. Most lamps will not permit of pulling down this far; in fact, many lamps upon the market are made so short that the hood will come clear off before parallel rays are obtained.

Having obtained a good strong light and parallel rays, the headband is adjusted to the head and the hole in the lens is brought directly in front of the pupil of the right eye. Closing the left eye, the operator looking through the hole with the right eye adjusts the mirror until the image of the light can be seen upon the palm of the hand. This assures parallelity of the illuminating and the visual axes. This is absolutely essential, for while the walls of the tube, if highly polished and undimmed, will reflect the rays obliquely backward and forward until they reach the object, yet the walls in use are always more or less dimmed by condensation and secretions resulting in loss of light. Further, with tubes of small diameter, relatively so few rays enter the tube that if there is even a little loss the object is very feebly illuminated. If in addition, more light is cut off by the introduction of instruments total darkness results.

No second person can put the headlamp on one's head like one's self. Therefore it should be put on and all adjustments should be made before the hands are sterilized. Minor adjustments constantly necessary in work, and the turning off and on of the switch (A. E. Fig. 1) if the cords be fitted with one, can be made with a bit of sterile gauze or a towel, held in the fingers.

Lower tracheo-bronchoscopy. Dorsal decubitus. This differs from upper tracheo-bronchoscopy chiefly in operating room detail, and in the much greater ease of its performance, especially in the hands of the inexperienced.

If the wound be made expressly for tracheo-bronchoscopy, all bleeding is stopped. If a previously tracheotomized case is to be examined, the wound is cleaned. In either case a Trousseau dilator is introduced and the trachea swabbed with a 20 per cent solution of cocain. After waiting a few moments for anesthesia to take place, the patient's head is turned slightly to the opposite side and the bronchoscope is introduced from the right side for the exploration of the left bronchus and vice versa. The bronchoscope is passed carefully by sight until the bifurcation is reached. As soon as the desired main bronchial opening is entered,

cough supervenes because the anesthetic has only been applied to the trachea. A swab moistened with 10 per cent cocain solution is passed down and the mucosa swabbed. At the secondary and tertairy bifurcations the cocain application will have to be made, probably in other places. This has to be done whether a general anesthetic is used or not, as ether is contra-indicated and chloroform anesthesia alone cannot safely be maintained at the depth necessary totally to abolish the cough reflex for any length of time. Cocain or morphin may be given hypodermatically.

Selection of tubes for the particular case. In regard to the sizes of tubes required for a given case, it may be stated that for lower tracheoscopy a tube 8 mm. x 20 cm. will be required for adults, and 5 mm x 14 cm. for children. For upper tracheo-bronchoscopy a tube 7 mm. x 45 cm. will be needed for adults and 5 mm. x 20 cm. for infants. In older children a 7 mm. x 20 cm. tube may be used. It is, of course, a great desideratum to use the largest possible tube. Fortunately the trachea and bronchi are dilatable so that the tube need not be much smaller than their diameter. But, of course, it must be remembered the size diminishes with each bifurcation. When a bronchus of such small caliber is reached that it is not wise to push the tube further, a smaller one should be introduced

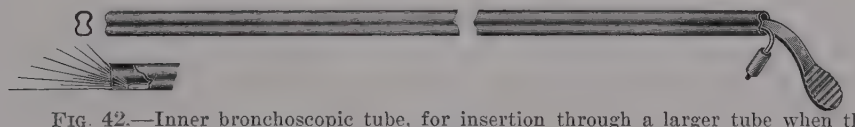


FIG. 42.—Inner bronchoscopic tube, for insertion through a larger tube when the latter has reached as far as its size will permit.

through the first. This inner tube (Fig. 42) may be pushed 4 or 5 centimeters further, which will serve to reach the periphery of the lung.

For instrumentation it is always of great advantage to use the largest possible tube.

Tracheotomy. For lower bronchoscopy the tracheotomy should be a low one; the lower the better. Not so much for the shortness of the tube thus rendered possible, but because the chin is so much less in the way. When necessary, however, it is feasible to tracheoscopize through the highest of tracheotomy wounds. The author has more than once tracheoscopically examined the trachea through a thyrotomy wound that did not extend into the cricoid cartilage.

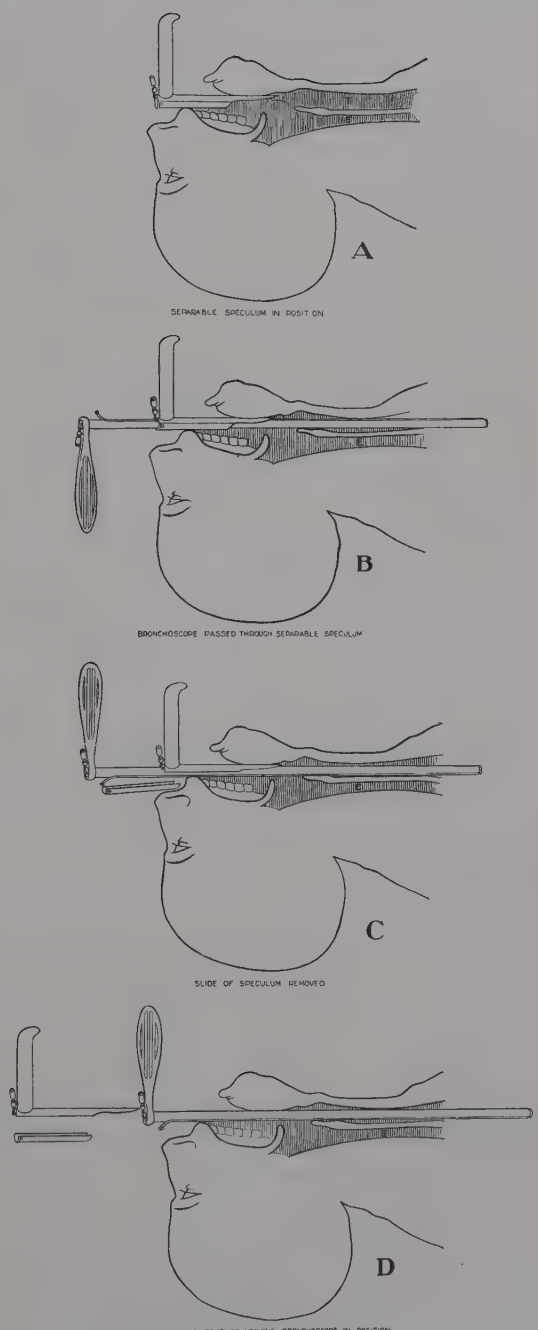
The dangers of tracheotomy may be minimized by attention to the following details:

The technic of both the tracheotomy and the bronchoscopy must be as near absolute asepsis as it is possible to make it.

The patient, during the operation and for 12 hours afterward, must

be kept in a semi-Trendelenburg position. That is there must be no pillow and the foot of the table, and later the foot of the bed, must be raised.

The tracheotomy wound must not be stitched except perhaps one stitch at the extreme upper and lower angles. The tracheal canula should, if possible, be abandoned before the patient leaves the warm, moist air of the operating room. The wound should be packed with gauze wrung out of mercuric bichloride solution 1:5000, and it should be repacked every 3 hours. Healing should be allowed to take place from the bottom, making sure of the binding together of the lips of the tracheal wound by fibrous tissue before the more superficial portions of the wound are allowed to close. If this be not done fungating granulations from uncovered cartilage will intrude into the trachea for a long time (see Fig. 12, Plate II).



SCHEMA ILLUSTRATING UPPER TRACHEO-BRONCHOSCOPY.

CHAPTER V.

Direct Laryngoscopy for Diagnosis and Treatment.

By laryngoscopy ordinarily is meant the examination of the image of the larynx as seen in the laryngoscopic mirror, by whose aid the interior of the larynx is illuminated.

By direct laryngoscopy is meant the direct inspection of the interior of the larynx without reflection of the image.

In order to do this, the base of the tongue and various structures above the larynx must be held out of the way, and the head must be thrown backward, in the manner described in the preceding chapter.

In general it may be stated that direct laryngoscopy for diagnosis and treatment is justifiable in all cases:

First, where these ends are not satisfactorily attained with the laryngeal mirror; and

Second, where the gravity of the disease renders it our duty to use every means to aid our patient.

This is a conservative statement based upon the present state of practice. The author believes the near fututre will see the tubular speculum in use for the routine examination of the larynx and upper end of the esophagus.

Dangers and Contra-indications

It may be stated that the danger of direct laryngoscopy, *per se*, under local anesthesia in the normal larynx is nil; and that absolute contra-indications are few. In cases with extreme dyspnoea from laryngeal stenosis there may exist indications for tracheotomy without the laryngoscopy, and it is in the hope, well founded, of obviating this operation that laryngoscopy is attempted, as in a number of cases in the author's practice, some of which are herein reported. It may, therefore, be stated that the danger arises from the condition calling for the proceedure and not from the proceedure itself. This is predicated upon skillful manipulation, the judgment as to when to stop in case laryngeal spasm is excited by the presence

of the tube, and upon the ability to stab the trachea instantly in case the attempt to avoid the tracheotomy proves unsuccessful. If no one is present who can do this, severe dyspnoea is a contra-indication. The gagging and attempted vomiting excited in those who have sensitive throats if not controllable by cocain, might be a contra-indication in such conditions as aneurysm and those with hard arteries and apoplectic tendencies.

The author has never yet seen a case in which he deemed it unsafe directly to inspect under local anesthesia or without anesthesia, the larynx, save those that demanded an immediate tracheotomy any way without a direct laryngoscopy. Of course, a general anesthesia introduces a risk of its own in any case, and it is an enormous one in case of dyspnoea. Should respiration fail, it will never be started again, unless the trachea be opened instantly. Delaying a tracheotomy, all the world over, at the present day, is a common, but unjustifiable and unnecessary risk in all kinds of obstructive dyspnoea.

Difficulties.

Rigidity of the neck, in elderly subjects, or in those suffering from various vertebral diseases, tubercular, rheumatic, traumatic or congenital spinal deformities, is at times a serious impediment by interference with a sufficient degree of extension of the head.

Spastic muscular contractions in young vigorous subjects with short thick necks, and a good full set of teeth are hindrances, though in most instances the difficulties disappear under general anesthesia.

Abundant secretions are a difficulty with ordinary plain tubes, but with the author's improved drainage system, the nurse pumps away the secretion as fast as it reaches the end of the tube. In the absence of this, it is necessary to interrupt the work frequently to insert the drainage tube of the aspirator, and armed sponge holders. The desire to expectorate or swallow, both of which are practically impossible with the mouth gagged open, is the cause of much discomfort to the patient locally anesthetized.

Cough would be one of the greatest difficulties to contend with, were it not for the fortunate fact that it is usually controllable by local and general anesthesia.

Respiratory difficulties. In working with a local anesthetic patients often struggle so violently to get up that the examination is interrupted. This is due in some instances to excitability or "nervousness," but usually it is due to a sense of suffocation. A great deal of trouble and difficulty will be avoided, if the patient is told beforehand that he will feel as if smothering, but that there is absolutely no danger, and that he must have confidence in the operator, and take matters quietly and easily. The sense of suffocation in direct laryngoscopy may come from spasm of the larynx from the presence of the tubular speculum, or from covering the laryngeal

orifice with the spatula which is pushed in too far, going behind the cricoid cartilage. In either case withdrawing the speculum slightly relieves the difficulty. In spasmodic conditions, cocain should be reapplied. If bronchoscopy is to be done, the bronchoscope may be pushed through the cords gently without injury even if they are in a state of spasm, though it is better, usually, to recocainize and wait.

In bronchoscopy the respiratory difficulty usually comes from failure to bring one of the breathing orifices of the tube opposite the orifice of the lateral branch which is shut off by the tube.

In patients wearing a tracheal canula the absence of glottic breathing sometimes renders the glottis less easy to find. Patients who have had previous laryngeal or tracheal disease involving the cartilages, or who have had operations performed upon the structures are less easy to examine on account of the cicatricial inflexibility.

Abrasion of the upper lip will frequently cause interruption of the procedure by the patient struggling in frantic efforts to indicate to the operator the cause of the needless pain.

The foregoing and all other difficulties are readily overcome by the skill that comes from practice and by quiet, orderly procedure.

It is always wise to have tracheotomy instruments prepared for every direct laryngoscopy as well as every tracheo-bronchoscopy or esophagoscopy. Not that they are likely to be needed except in the dyspnoeic cases, and only rarely in these, but it is a good safe routine to drill the nurses into, so that when needed no time will be lost. If this be not done, it is quite certain that when needed they will not be on hand. It is only in general narcosis that they are likely to be required. It is certain that in serious respiratory arrest occurring in any sort of case, it is often impossible to start respiration without tracheotomy. Indeed, it should be the routine of every operating room to have tracheotomy instruments sterile and ready for every case of any kind in which a general anesthetic is used.

It is also advisable in all cases of direct laryngoscopy and esophagoscopy to have at hand a small bronchoscope that can be pushed into the larynx in case of respiratory arrest and thus save the necessity for tracheotomy. If the operator is not facile at passing a tube through the glottis, the tracheotomy should be done at once.

These matters are mentioned as wise precautions that any operator of experience in laryngeal and tracheal diseases will understand and appreciate. As a matter of fact, ordinarily, direct laryngoscopy and tracheobronchial or esophageal endoscopy involve no risk of respiratory arrest, and it is hoped that the mention of respiratory arrest will not induce the inexperienced to regard them as serious procedures.

"It is the unexpected that happens," might be parodied: "It is the unprepared for that happens," though logically unprovable.

Direct Laryngoscopy for Foreign Bodies.

Foreign bodies in the larynx are in all cases more promptly, more safely and less painfully removed by direct than by indirect laryngoscopy, which latter is now obsolete for this purpose. Not one in a dozen cases has a sufficiently tolerant larynx to render feasible the removal of a foreign body with perfect safety to his vocal apparatus. In almost all instances foreign bodies can be removed from the larynx without pain or danger with the aid of the tubular speculum. The exceptions are the cases in which the foreign body is sharp or impacted, or in those having a dangerous stenosis from acute edema or the presence of the foreign body itself. In these cases, tracheotomy will occasionally be necessary though much less frequently than by any other method. It should, of course, always be prepared for as a matter of routine, so that when needed, everything will be at hand for quiet, orderly procedure.

The technic in general has been considered in a previous chapter. Cocain anesthesia is sufficient in most cases, and general anesthesia should be especially avoided in cases where there is the slightest dyspnoea or stridor.

Forceps of various forms and a hook will be needed for the best results in dealing with every case encountered, though in most cases the forceps shown in Fig. 22 will be sufficient. In cases such as of coins or similar flat objects lying crosswise with an edge in each ventricle, a right angled forceps such as shown in Fig. 25, but with thin and flat, instead of punch shaped jaws, will be best. In a case referred to the author by Dr. Crawford, a button was lying not in the ventricles, but crosswise below the cords, fixed by the swollen mucosa (Fig. 7, plate I). The child, a boy of 14 years, had been playing with a hard rubber button through the holes of which a loop of string had been tied. While jerking thus against his teeth the center of the button pulled out and the button was aspirated. Violent coughing and deep cyanosis followed immediately but cleared up and recurred every few minutes for several hours. After one of these paroxysms, loud whistling breathing was noticed and continued until the patient was seen by the author the following day. There was slight cyanosis increased by exertion. Upon attempting an examination with the laryngoscopic mirror the child became so cyanotic that it was feared that immediate tracheotomy would have to be done. Upon direct laryngoscopy under cocain anesthesia, the button was seen in the position shown. It was evident that the button had been fixed by the swollen mucosa and that the whistling came from the passage of air through the hole in the center. A hook was slipped down flatwise in the interarytenoid space until below the button, then turned sidewise and brought up until the point entered the ragged hole in the center. The button was then pulled against the end of

the tube, turning edgewise as it came upward. Then tube, hook and button were pulled out as one piece. The child made a good recovery without impairment of the voice.

As illustrating the advantages of direct laryngoscopy in a very dyspnoeic case of impacted foreign body in the larynx, the following case may be cited:

Infant G., aged 9 months, a croupy cough, with slight elevation of temperature. A diagnosis of membranous croup was made by an expert diagnostician, and antitoxin given. The temperature fell to normal but the croupy cough persisted for a month and other advice was sought by the parents who suspected that a piece of egg shell with which the child had been playing had lodged in the throat. Dr. Moyer and Dr. Wechsler, who each saw the case independently, made a probable diagnosis of foreign body in the larynx, in spite of a negative radiograph by an expert Roentgenologist, and referred the case to the author for exploration. On admission cyanosis and dyspnoea forbade a mirror examination, and even cocainization was not attempted. Upon passing the tubular speculum a fragment of egg shell was seen on edge lying between two edematous masses as shown in Fig. 6, Plate I. It was quickly removed with forceps, and the child watched all night in anticipation of the need of a tracheotomy, which, however, was not required. In a few days the perichronditis and mucosal ulceration set up by the month's sojourn of the egg shell in the infant larynx had subsided. This case points several valuable lessons. It is unwise for any practitioner persistently to reassure patients or their relatives with the statement that there is no foreign body present and that if present it could do no harm. Strange as it may seem, it is the custom with many practitioners to oppose not only a search for a foreign body but its removal, when found. This course is a relic of the days when attempts at removal were crudely and blindly made. The other lesson taught by this case is that when symptoms point to a foreign body, it is better to explore even if the radiograph by an expert Roentgenologist be negative. More will be said in a future chapter on this subject.

Direct Laryngoscopy for Diseased Conditions.

In *malignant diseases* of the larynx, direct laryngoscopy is of the greatest utility for diagnosis. The naked eye diagnosis is greatly aided, and the taking of a specimen instead of being a difficult uncertain groping procedure, is done with a precision and a nicety that makes direct laryngoscopy a necessary procedure with the laryngologist. The cup-shaped or punch-like jaws should be used in the forceps for this purpose, and where possible the piece bitten out should include both pathologic and ap-

parently normal tissue; in other words, it should be taken from the border of the growth.

The diagnosis of paralyses is better made with the old indirect method of laryngoscopy, for the pressure of a laryngeal speculum interferes somewhat with motility in certain individuals. With this exception, however, the diagnosis of all laryngeal diseases is greatly facilitated by direct laryngoscopy. In children, indirect laryngoscopy is often difficult, and at times it is impossible to see beyond the epiglottis. Of course, when anesthetized, indirect laryngoscopy is easily carried out in children, if the tongue is drawn out with a piece of silk worm gut passed through it. The great disadvantage is that most diseases of the larynx in children are absolute contra-indications to anesthesia. Local anesthesia is usually sufficient for direct laryngoscopy. Very unruly children will have to be held firmly, as the procedure may terrify, though it is not painful in the young, whose tissues are always yielding. The reflex coughing and gagging make it seem to the onlooker a desperate procedure, and relatives should always be excluded from the room.

For the treatment of malignant disease, endolaryngeal methods are, in the author's opinion, absolutely contra-indicated in the present state of our knowledge. Some day a therapeutic cure will be discovered, and should that cure be by topical application direct laryngoscopy will be the method of applying it. But at present, direct laryngoscopy is of aid only in the diagnosis.

Benign neoplasms offer a wide field for not only the diagnosis but for treatment with the aid of direct laryngoscopy.

Papillomata in adults may be removed with good chances of complete cure, at a single operation. The serrated jaw forceps (Fig. 22) should be used for pedunculated growths, following with the cup-shaped jaws (Fig. 24) with which the entire base should be bitten out along with some normal tissue. In some cases the laryngeal speculum is not sufficient and the tracheoscope will have to be passed, as the growth, though presenting above the cords, has a long pedicule springing from a subglottic portion of the larynx. The best procedure in subglottic cases often is to push the tracheoscope on past the growth and then to withdraw it until the growth drops in front of the tube.

When springing from the anterior angle of the larynx at or above the cords, the most skillful technic is necessary to extirpate the growth by direct laryngoscopy under local anesthesia in an adult. In a young, vigorous, muscular adult, all the anterior cervical muscles are thrown into a state of tetany by the reflexes, and the hyoid bone and attached tissues do not yield readily to pressure unless relaxed by general anesthesia. The curved jaws, (Fig. 23) turned to point upward, are very convenient for

removing growths from the anterior angle, or better still the punch jaws (Fig. 25). For other locations, intrinsic and extrinsic, the instruments of Mosher, (Fig. 5) designed for the upper end of the esophagus, are convenient for use through the laryngeal speculum.

Papillomata in children may be very readily removed from any portion of the larynx, and usually under local anesthesia. They are almost certain to recur, so that many sittings are necessary. In one case a girl of four years, the author removed recurrent multiple papillomata twenty times and the end is not yet near. Tracheotomy is not necessary, if the growths are small, but should always be prepared for. The wearing of a tracheotomy canula is supposed to inhibit growth and retard recurrence. Thyrotomy is absolutely contra-indicated for papillomata in children, and the best method known to-day is repeated endoscopic removal with or without tracheotomy.

Other benign laryngeal neoplasms as fibromata, angiomata, edematous polypi, lipomata, chondromata, cysts, etc., are very satisfactorily treated through the direct laryngeal speculum.

Singers nodes are also amenable to local direct treatment.

Laryngeal tuberculosis occurring as a complication of pulmonary or general tuberculosis, or in the form of a local lesion as lupus, or as a chronic tubercular abscess of a crico-arytenoid joint, may be treated medically and surgically by direct laryngoscopy, and with a precision possible in no other way save by thyrotomy, which will not often be required by the patient of the facile direct laryngoscopist.

Inflammatory diseases, especially in their edematous phases, have never been handled with the facility now possible. At the Eye and Ear Hospital, in a number of very severe cases which ordinarily would have been tracheotomized at once, the author made a dozen punctures in the edematous tissues in less than a minute with the knife (Fig. 29) evacuating the serum and curing the cases promptly and safely. A bronchoscope was kept at hand so that should asphyxia threaten, it could be pushed through the glottis and thus relieve the dyspnoea; but the necessity did not arise. Many less urgent cases have been quite as satisfactorily dealt with.

In abscess of the larynx, following edematous laryngitis or other acute or chronic cause may be evacuated with precision and without risk to local structures or to life.

Cicatricial Stenoses of the larynx consisting of fibrous webs, adhesions, and cordal synechiæ when not complicated by deformity from cartilaginous necrosis, are best treated by endoscopic incision of the cicatrices, followed by prolonged intubation. The author has successfully treated a number of such cases following typhoid fever, erosions from prolonged

sojourn of foreign bodies and intubation tubes, etc. When prolonged intubation is to be used after the incision of cicatrices, the tube should be removed every 5 or 6 days lest concretions on the tubes lead to ulceration and fresh cicatrices. This is less likely to happen with hard rubber intubation tubes.

Laryngeal Paralyses. For the galvanic and Faradic treatment of laryngeal paralyses the author has devised a monopolar electrode (Fig. 43) with which applications may be made with nicety to the various muscular groups and it is a beautiful sight to see the muscles work thus at the operator's will. This, of course, is only possible in recent conditions prior to atrophic change, and must be done with caution in untracheotomized cases. In a case of bilateral abductor paralysis sent to me by Dr. F. D. Johnston, the muscle play was beautiful, but the muscles eventually lost their electro-excitability after going through an increased excitability, followed by a period in which they showed a reaction of degeneration. This case had been previously tracheotomized by the author for dyspnoea. In a case not tracheotomized due caution must be exercised.

The rules and indications for the application of galvanism and Faradism, strength of current and other matters are not within the scope of

FIG. 43.—Monopolar laryngeal electrode for Galvanism and Faradism.

this work. Endoscopic applications, of course, follow the same rules as apply to applications by the difficult, uncertain, indirect method with curved electrode and laryngeal mirror.

The technic is simple. The one pole (positive or negative, as desired) is applied with a "sponge" electrode held by a nurse to the neck externally, while the operator touches the desired point with the monopolar endo-laryngeal electrode under direct inspection through the tubular speculum. A bi-polar instrument has also been used by the author, enabling the use of both poles within the larynx. Its application is not much more difficult, but it has not yielded any better results than follow mono-polar endolaryngeal applications. In all forms of recurrent paralyses, the external electrode should be applied on the course of the recurrent as low in the neck as possible.

In *sensory laryngeal neuroses* as anesthesia, hyperesthesia, and paresthesia the local application of the Faradic and the constant currents are of great therapeutic value. They can be applied to the pyriform fossæ in close proximity to the course of the superior laryngeal nerve with the elec-

trode (Fig. 43) passed through the laryngeal speculum. In paresthesia the same application is useful.

For the application of the cautery, electric or chemical, the tubular speculum lends itself as a most necessary aid. Personally, the writer's experience is not very favorable with these agents, however applied, but if used at all, it should be by the direct method. Be the apparatus ever so ingeniously devised and the operator incomparably facile, the indirect method is at best uncertain, and the application is apt to be made where not wanted.

Congenital webs of the larynx, while not strictly diseased conditions, may be considered here. They are quickly and accurately dealt with endoscopically, using the straight laryngeal knife (Fig. 29) and making such incisions as may be planned for the particular case. In some instances, it may be necessary practically to carve out and form a cord or a pair of cords.

FIG. 44.—Galvano-cautery electrode for use through the tubular speculum.

RETROGRADE LARYNGOSCOPY.

In many instances valuable information can be obtained by looking upward at the larynx from below. It should be a matter of routine thus to examine every case requiring tracheotomy for laryngeal obstruction. The cords may be seen to move beautifully where there is no paralysis or fixation. The lesions of inflammation, syphilis, tuberculosis, typhoid fever, diphtheria, etc., are revealed. While these are not so often infra-glottic as supra-glottic, yet they occur and should be sought for. In two instances the author has discovered a malignant infiltration that had escaped indirect laryngoscopic observation from above by the good laryngologist attending the cases. Obviously it is only called for when the tracheotomy wound is low, not extending to the thyroid cartilage.

The method is simple. A short tracheoscope (5 mm. x 14 cm. for a child, 8 mm. x 20 cm. for an adult), is inserted in an upward direction, after cocainizing the mucosa.

CHAPTER VI.

Anatomy of the Tracheo-Bronchial Tree, Topographically, Radiographically and Endoscopically Considered.

An absolute essential to the best work in a difficult case is a knowledge of the anatomy of the tracheo-bronchial tree *as seen from the inside* in the living.

For this purpose the anatomical works afford little help. To begin with the illustrations are upside down for the tracheo-bronchoscopist working on the recumbent patient; and, further, the older works are in some instances absolutely erroneous.

A brief synopsis is all that comes within the scope of the present work. For further anatomical details the student is referred to the cadaver. The bronchoscope has opened up a large field for original work in practical broncho-pulmonary anatomy, normal as well as pathologic.

The trachea just below its entrance into the thorax deviates slightly to the right, to allow room for the aorta. At about the level of the second costal cartilage in adults, the third in children, the trachea bifurcates into the right and left main bronchi. This corresponds to about the fourth or fifth thoracic vertebra, the trachea being elastic and displaced by various movements. These landmarks are of value in the interpretation of radiographs.

The non-branched part of the right main bronchus is steeper and shorter and wider than its fellow of the opposite side, and is practically the continuation of the trachea, while the left might be considered as a branch. This is seen in Figure 45. The right bronchus gives off first the superior lobe bronchus, (SL), then the middle lobe bronchus, (ML), the continuation downward being the inferior lobe bronchus (IL). The superior lobe bronchus is the only bronchus classed as eparterial; that is given off above the crossing of the pulmonary arteries. All the others come off below the crossing and are classed as hyparterial.

The left main bronchus gives off first the superior lobe bronchus (SL), the continuation being the inferior lobe bronchus (IL).

The bronchial branches are classed into dorsal and ventral groups, four in each group. This is by no means constant. An occasional anomoly is a fifth right bronchus sometimes called a cardiac bronchus. The ventral branches are usually the longer.

As just mentioned, the bifurcation of the trachea is at the level of the intervertebral disc between the fourth and fifth dorsal vertebræ; and the anterior landmark is, in adults, the second right chondro-sternal articulation. In a child of 2 years, on account of the more nearly horizontal direction of the ribs, the level is that of the third chondrosternal articulation. When the patient is between two years and adult life, the point must be estimated pro rata.

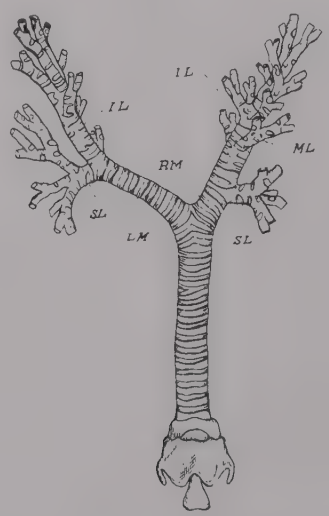


FIG. 45.—Tracheo-bronchial tree.
L M, Left main bronchus; S L, Superior lobe bronchus; M L, Middle lobe bronchus; I L, Inferior lobe bronchus.

The bifurcation is usually a little to the right of the medium line; about half way between the vertical center line of the sternum and its right border. This varies, of course, though slightly, with the position of the body and with the respiratory movements.

The deviation of the right bronchus is usually about 25°, and its length unbranched, measured from the bifurcation, is about 2.5 cm. The deviation of the left bronchus is about 75°, and its length is about 5 cm. These angles and distances laid off, upon a radiograph, from the bifurcation as indicated by the landmarks just referred to, will give the location

of the first branch of the respective main bronchi. These are the landmarks most important radiographically, and for the lateral plane, they are fairly constant and very satisfactory, both for the location of foreign bodies and diseased areas at or above these points. For localization below, they are accurate enough, so far as the lateral plane is concerned, but beginning with the first branch of the bronchi below the bifurcation, the anteroposterior plane has to be studied, and here the radiograph is not of much aid on account of the distance the rays must pass through the body before reaching the plate, in attempting to take a lateral view of the thorax. However, having localized a foreign body or diseased area in reference to the tracheal bifurcation and the first branch of the main bronchus, we will have accomplished all that is needed in the majority of cases, and in instances of involvement of even the deepest bronchi, we will have reduced the area to be explored to very narrow limits. Much remains to be accomplished in the topographic, radiographic, and endoscopic study of the finer subdivisions of the bronchi and their relation to peripheral lung areas.

Dimensions of the trachea and bronchi. While the lumen of the individual bronchi diminishes as they bifurcate the sum of all the areas shows an increase of total tubular area of cross section. Thus, the sum of the areas of cross section of the two main bronchi, right and left, is greater than the area of cross section of the trachea. The same is true of each bronchial branching. This follows the well known dynamic law. The relative increase in surface as the tubes diminish in size increases the friction of the passing air, so that an actual increase in area of cross section is necessary. This is a fortunate thing for the tracheo-bronchoscopist. If the area of cross section were cut in half at every bifurcation he would not get as near the periphery as he now does.

The dimensions of the tracheo-bronchial tree may be epitomized approximately thus:

	Adult Male.	Female.	Child.	Infant.
Diameter, Trachea	14x20 mm.	12x16 mm.	8x10	6x7.
Length Trachea	12. cm.	11. cm.	6. cm.	4. cm.
" Right Bronchus	2.5 "	2.5 "	2. "	1.5 "
" Left "	5. "	5. "	3. "	2.5 "
" Upper Teeth to Trachea	15. "	13.	10.	9.
" Total to Secondary Bronchus	32.	28.	19.	15.

These dimensions, especially those given in the last line, are subject to wide variations, and are only approximate. They were taken from the cadaver. The diameters do not take into account the dilatability of the trachea and the amount of yielding of the membranous posterior wall.

When the foregoing table is used as a basis for the selection of tubes, several things must be taken into consideration. The full diameter of the trachea is not available for upper tracheo-bronchoscopy, on account of the

glottic aperture which in the adult is an equilateral triangle measuring approximately 12 x 22 x 22 millimeters, and permitting of the passage of a tube not over ten millimeters in diameter without risk of injury.

As to length, a number of additional centimeters will have to be allowed. The tube must project above the upper teeth for convenience in working.

As to the length of tube required to reach below the first branch of the bronchi, tubes of 45 cm. and even 50 cm. will occasionally be required, though these very long and necessarily slender tubes are usually introduced inside of shorter and wider ones. In many instances, a view is had, and probes and applicators are passed, beyond the tube so that a full length is not always required.

The endoscopic appearances of the trachea and bronchi are interesting and their study is easily accomplished. The appearance of the interior of the trachea is familiar to all who have used the laryngeal mirror. The interior of the bronchi in the living was never studied until the advent of the bronchoscope.

As seen in the bronchoscope the trachea is a tube slightly flattened on the posterior wall. It assumes in some instances a greater or lesser tendency to an elliptical outline, the longer axis being variously placed. This is noted more particularly in two locations. The upper flattening is in the cervical portion and is due to pressure of the thyroid gland. The lower one is intra-thoracic, just above the bifurcation, and is due to the pressure of the aorta. This flattening is rythmically increased with each pulsation. In children a flattening is occasionally noticed due to pressure of the thyroid gland. In mentioning these flattenings reference is had only to conditions strictly within the limits of health. All these changes of outline may be enormously exaggerated, even to entire obliteration of the tracheal lumen, in diseased states.

The entire trachea is often seen to deviate slightly, usually toward the left, and occasionally it is seen to deviate first in one direction, then in another, making a slight tendency to an S curve.

The mucosa of the trachea is moist and glistening, whitish in circular ridges corresponding to the cartilaginous rings, the intervening grooves being reddish.

At the bottom of the trachea a white shining ridge is seen to divide the trachea antero-posteriorly into two unequal parts. The ridge shades off anteriorly and posteriorly into two reddish triangles. On the left of the ridge is the slanting orifice of the left main bronchus, and on the right, its larger fellow.

Passing the tube down the right bronchus, a view is presented that differs considerably in different instances. The view shown in Figure 11,

Plate II, is from a water color drawing of the right bronchus of a man 25 years of age. In Figure 47 the same view is shown without color. At the right (SL) is seen the orifice of the first branch, the upper lobe bronchus. Farther down anteriorly is seen the orifice of the middle lobe bronchus (M). At the left (I) we look into the depth of the inferior lobe bronchus in which the orifices of ventral and dorsal branches are seen.

In Figure 46 is shown a bronchoscopic view of the left bronchus of this same man (see also colored Plate II, Fig. 10). At S is seen the opening of the superior lobe bronchus while the entire right of the view shows the inferior lobe bronchus, (really the continuation of the main bronchus) with the openings of the dorsal and ventral branches in more or less perspective. It will be noted that the dorsal and ventral branches are not given off opposite each other.

The reference letters are duplicated in the illustration of the tracheo-

FIG. 46. FIG. 47.
Bronchoscopic views.
Left bronchus. Right bronchus.
S, Superior lobe bronchus.
S L, Superior lobe bronchus.
I, Inferior lobe bronchus.
M, Middle lobe bronchus.

bronchial tree, Figure 45, and it will be found useful to study these together. Not that they are to be taken as accurate representations of constant anatomical types, but, rather, as a suggestion as to how the tracheo-bronchial tree is to be studied endoscopically. The illustrations are semi-diagrammatic.

The mucosa of the bronchi is similar to that of the trachea, showing, however, differences meriting the closest scrutiny.

The movements of the trachea and bronchi as observed endoscopically in health and disease are worthy of study, of which they have as yet received but little. The normal movements may be classified as respiratory, pulsatory, and deglutitory. The two former being rythmic the latter being noticed occasionally, and only in lower tracheoscopy. Various spasmodic and transmitted movements, the true nature of which has not yet been demonstrated, have been noted.

CHAPTER VII.

Tracheo-Bronchoscopy in Diseases of the Trachea and Bronchi.

The brilliant work in the removal of foreign bodies has led to the impression that tracheo-bronchoscopy is useful for this only. The near future, however, will see the bronchoscope, and even more the tracheoscope and tubular speculum, in frequent use for the diagnosis and treatment of diseased conditions.

The diseases of the trachea and bronchi in which tracheo-bronchoscopy is useful may be divided into non-stenotic and stenotic. All cases of stenosis of the trachea or bronchi justify tracheoscopy, upper or lower, as may be indicated. Of the non-stenotic tracheal diseases it is chiefly those in which no satisfactory view is obtainable by indirect or direct laryngoscopy that will demand tracheoscopy. Of non-stenotic bronchial diseases, many that cannot be said at the present day to demand bronchoscopy, certainly should be investigated from a scientific point of view, as thus our knowledge of many bronchial and pulmonic conditions will be increased.

Non-stenotic morbid conditions of the trachea and bronchi may be tabulated the same as the stenotic diseases, the difference being chiefly of degree.

In addition, however, there are a number of diseases rarely associated with stenosis. Acute and chronic inflammatory conditions of a mild type usually called "catarrhal," objectionable as this word may be, will occasionally demand tracheoscopy when they cannot be examined by indirect or direct laryngoscopy. Many of the chronic inflammatory conditions will require tracheo-bronchoscopy, not only for diagnosis but for treatment of the diseased conditions revealed. Many a case labelled nervous cough, and allowed to annoy the patient and relatives for months will be found, when tracheo-bronchoscopized, not only to be due to visible lesions, but to lesions that can be cured.

In a case of this kind referred to me by Dr. L. W. Swope, an annoying cough of several months' duration, which had been disturbing rest and producing emaciation, was promptly cured by six direct swabbing applications of argentic nitrate to a non-specific ulcer discovered, at the bifurcation of the trachea, by tracheoscopy. Ulcerations more deeply seated, as in another case of the author's at the bifurcation of a bronchus, may be discovered and treated.

Chronic tracheal inflammation, that does not yield to treatment based upon indirect laryngoscopy, justifies direct laryngoscopy or tracheoscopy for diagnosis and treatment. The same may be said of ozena, if necessary for diagnosis, but the results of treatment are so far too discouraging to render it advisable.

Pus foci near the periphery of the lung may be endoscopically evacuated or may be localized for the general surgeon to attack externally. Necessarily the cases of this kind of tracheoscopic possibilities will be those in which communications have been established with the bronchi of not too small lumen. Knowing the anatomy and the normal endoscopic appearances, the bronchoscopist starts his tube downward from the tracheal bifurcation, noting the orifices of the lateral branches as they are passed until a bronchus is reached in which disease products are found, or the walls of which give ocular evidence of disease, as inflammation, perforation, granulation. Specimens may be taken with a mop or aspirated into the accessory drainage tube. As orientation is not easy, a radiograph may be taken after blowing in bismuth oxide through a dry extra drainage tube. Abscesses of the lung due to the presence of a foreign body may be thus localized; and if the foreign body cannot be removed endoscopically, a probe passed through the bronchoscope into the pus focus can be felt through the lung and pleura after the thoracic wall is opened.

Stenoses of the trachea may be classified as to their pathologic mechanism into peri-tracheal, muro-tracheal and endo-tracheal conditions. Bronchial stenoses may be likewise classified.

In considering peri-tracheal conditions causing stenosis we must remember that the trachea, though not soft as compared with the esophagus, is not a rigid tube. It is very readily compressible, and is subject to the encroachment of cervical and intra-thoracic tumors. Peri-tracheal conditions producing stenosis include glandular hypertrophies, glandular (lymphatic) infiltrations, aneurysm, benign and malignant tumors of adjacent tissues.

The great frequency of stenosis from these peri-tracheal and peri-bronchial conditions was not known until the development of tracheo-bronchoscopy, as in many instances they do not show at autopsy.

Of glandular hypertrophies the most frequent is the thyroid. Struma intrudes upon the tracheal lumen much more frequently than was suspected until tracheoscopy was extensively practiced. The outline of the cross section of the tracheal lumen may be compressed from before backward and to one side as in Figure 2, Plate I, drawn from a case of goitre in a man 36 years of age. Or it may be compressed in addition from behind forward by the retro-tracheal portion of the goitre producing a narrow oval slit, the so-called "scabbard" trachea.

The long axis of the ellipse is more apt to be at an angle than exactly in the transverse plane owing to the relative frequency of asymmetric struma.

For many years it has been a disputed question as to whether the thymus gland can compress the trachea. It has been the author's privilege to demonstrate tracheoscopically the error of Friedleben's dictum, *"Es giebt kein asthma thymicum."*

This case, already reported, is here briefly abstracted:

Case XXI, Earl L., aged 4, was admitted for dyspnoea and stridorous breathing, increasing since the sudden onset of a croupy attack six weeks before. Immediate tracheotomy by the author failed to relieve the dyspnoea, but the passage of a tracheoscope relieved it completely. The walls of the trachea were collapsed from before backward (Fig. 5, Plate I) and they opened up ahead of the tracheoscope like the cervical esophagus, and like those of the esophagus they tended to close on expiration. One of the author's long tracheal canulæ was inserted which relieved the dyspnoea, and later held the trachea open while the little finger was passed behind the sternum into the anterior mediastinum, and while the thymus gland was thus brought up and removed. The dyspnoea never recurred and a complete cure resulted, without ill effect from the absence of the gland. (Fig. 48.) A radiograph by Dr. Russell H. Boggs shows the hypertrophied gland before operation. (Fig. 49.)

This case demonstrates the diagnostic value of tracheoscopy in compression tracheo-stenoses. In the absence of his long tracheal canulæ the author has more than once used a tracheoscope as a temporary canula until one of the latter of proper length could be procured.

Infiltrated lymph nodes frequently produce stenosis of the trachea and bronchi. Fig. 15, Plate II, shows compression stenosis of the right bronchus thus produced, in a woman of 26 years.

Benign and malignant tumors of the peri-tracheal tissues produce compression stenoses. Such a case is illustrated in Fig. 9, Plate I, which is drawn from the case of a man, aged 60, in whom an epithelioma of the thoracic esophagus produced a compression stenosis of the trachea. Later the tracheal wall became secondarily involved by extension of the infiltra-

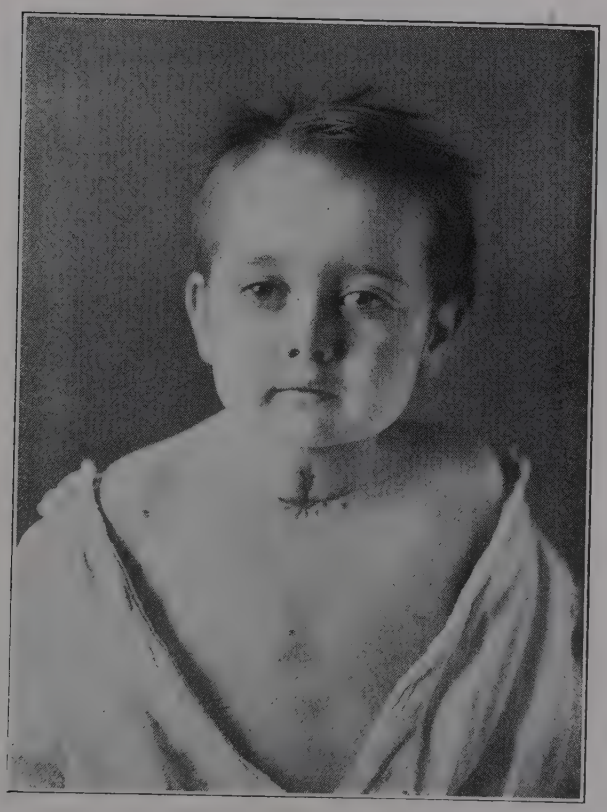


FIG. 48.—From photograph of patient 4 months after thymectomy. Case of thymic tracheo-stenosis diagnosticated tracheoscopically.

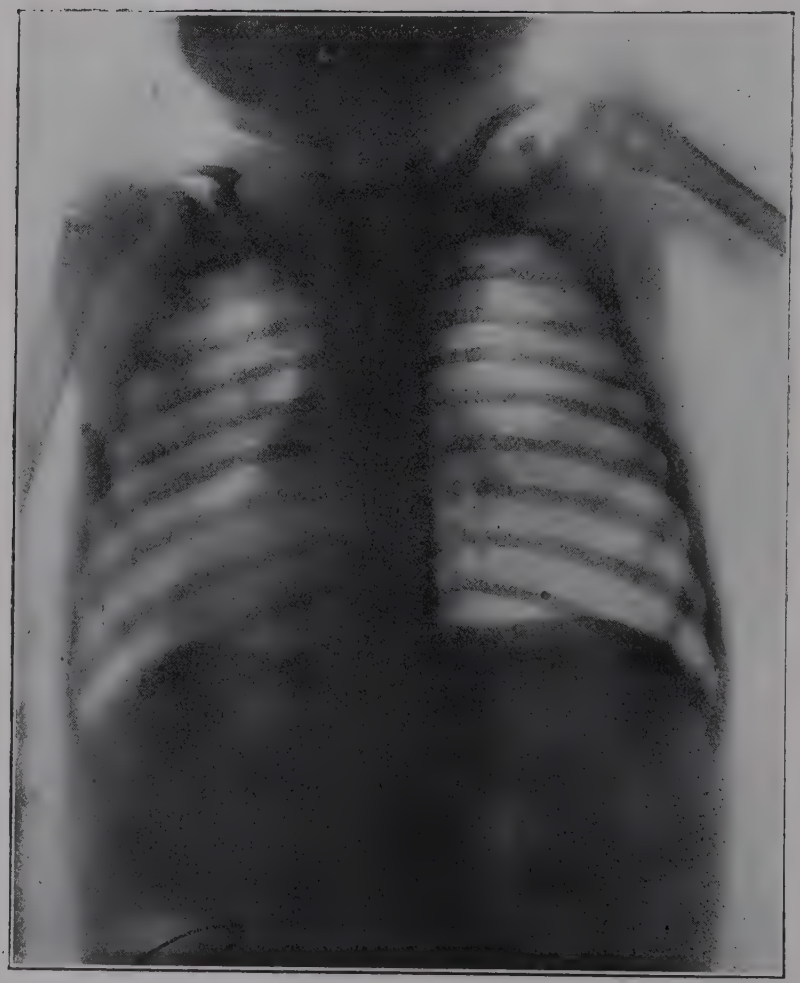


FIG. 49.—Thymic tracheo-stenosis. Radiograph showing gland before operation.

tion. Mediastinal tumors are frequently the cause of tracheal compression.

Aneurysm is a not infrequent invader of the trachea and bronchi, as shown in Fig. 3, Plate I, drawn from the case of a man aged 50, a physician. The excursion of each pulsation is shown by the dotted line. This pulsatory excursion inward of one portion of the tracheal wall must not be confused with the transmitted cardiac or aortic impulse in which the entire trachea is pushed or tugged aside. A radiograph of this case is reproduced in Fig. 50.

In Graves' disease the transmitted pulsations may simulate aneurysm.

Some observers have seen an aneurysm on the eve of bursting into the trachea.

Various peri-tracheal and peri-bronchial inflammatory conditions, as Ludwig's angina, abscess, etc., and also other states such as emphysema from wounds or disease of the upper and lower air passages also compress the bronchial and tracheal walls, as do also mediastinal diseases occasionally.

Muro-tracheal and muro-bronchial conditions producing stenosis may be enumerated as:

1. Malignant neoplasms.
2. Benign neoplasms.
3. Specific inflammations,
    a. Syphilis,
    b. Tuberculosis,
    c. Glanders,
    d. Typhoid fever,
    e. Diphtheria.
4. Inflammations,
    a. "Catarrhal,"
    b. Irritative,
    c. Traumatic,
    d. Operative,
    e. Post operative.
5. Ulcerations associated with the foregoing conditions.
6. Post inflammatory conditions as cicatrices, hyperplasia and adhesions.
7. Vaso-motor disturbances, angio-neurotic edema.

Benign neoplasms, while not frequent, are seen occasionally by the tracheoscopist and are especially adapted to endoscopic treatment.

Fig. 1, Plate I, shows a papilloma of the trachea in a child of 4 years, under the author's care at the Eye and Ear Hospital.

Of the specific inflammations, syphilis is by far the most frequent

FIG. 50.—Radiograph showing location of aneurysm that produced tracheal compression and recurrent paralysis.

cause of stenosis, in, first, its edematous and later in its cicatricial stage. Fig. 8, Plate I, is a tracheoscopic view of post syphilitic tracheal stenosis in a man aged 24, referred to me by Dr. Frank Trester Smith.

In typhoid fever as in all of the conditions enumerated, the tracheoscope may render valuable services. By this it is not meant that we should go through the wards of a hospital and pass the tracheoscope on every case of typhoid fever. But, to illustrate, a number of the cases of typhoid fever in the Western Pennsylvania Hospital that required tracheotomy were examined by the author tracheoscopically after the tracheotomy. Lesions were discovered that would be invisible by any method other than tracheoscopy.

The detailed consideration of diseases of the trachea is without the scope of this work and the subject is briefly alluded to as showing the enormous field of usefulness open to tracheo-bronchoscopy.

The reader who is interested is referred to the bibliography appended, and in particular to the papers of Rodgers, Simpson and Chiari, on tracheal stenoses, Theisen on tumors of the trachea, and Newcomb on diseases of the trachea, and to the work of von Schrötter on all of these subjects.

Cicatricial tracheal stenoses offer a wide field of usefulness for the tracheoscope. These cases formerly were often very difficult of diagnosis by the old indirect mirror method. A tracheotomy occasionally aided, but very often it did not. Now any case of tracheal stenosis may be positively diagnosticated by direct laryngoscopy or tracheoscopy.

Cicatricial tracheal strictures may be of traumatic, post-operative, post-ulcerative, luetic, tubercular or other origin.

As examples the following cases may be reported:

Case VIII. *Penny in esophagus 2 months. Erosion through into trachea. Cicatricial tracheal stenosis. Cure.* Seen in consultation with Dr. Sandels and Dr. Ryal. Raymond B., aged 2 years, had a penny in the esophagus for two months. (Fig. 51.) For two weeks after the accident he had some dysphagia which became better, as increasing cough and dyspnoea developed. Cyanosis was so great on admission that immediate tracheotomy was necessary. The penny was removed from its ulcerated bed by the esophagoscopic method, and the child allowed to go home. Three weeks later he was brought in, quite cyanotic again, and upon passing the tracheoscope the cicatricial web shown in Fig. 4, Plate I, was seen. A complete cure resulted from prolonged intubation and forcible dilatation. There was no stenosis of the esophagus.

Remarks: This case illustrates the danger of a swallowed foreign body. The ease with which intubation tubes pass through the alimentary canal is apt to lead us into the error of supposing that anything swallowed is harmless, especially if without sharp points or edges, as in this

FIG. 51.—Radiograph of a penny in esophagus, producing tracheal stenosis after two months, by ulceration through the tracheo-esophageal wall.

case. This child, if unrelieved, would have been dead of septic pneumonia in a few days, from the pus which was being aspirated down the trachea into the lungs.

Fig. 8, Plate I, shows a cicatricial web producing partial occlusion of the tracheal lumen in a man aged 33, sent to me by Dr. Frank Trester Smith, of Chattanooga. This stricture was incised and dilated, with satisfactory results, though a laryngeal stenosis in the same case could not be relieved.

Cicatricial strictures of the bronchi from causes similar to those producing tracheal stricture are occasionally encountered. Fig. 14, Plate II, is a good example of this condition, in a man of 33.

Deviations of the trachea without stenosis are frequent. They may occur as anomalies or as a displacement by peri-tracheal tissues. One very interesting case of this kind in a woman of 23 years was referred to me by Dr. Ewing W. Day. There was a sharp deflection forward to the left, then backward to the right. The axis of the lumen of the larynx was from above downward and backward, the downward-forward-left deviation starting abruptly below the cricoid cartilage. There was marked ptosis of the larynx, the lower border of the thyroid cartilage being back of the sternum, and all of the trachea being subglottic. The esophagus followed the same deviations as the trachea, which would seem to indicate that the anomaly was not congenital. Two cervical ribs were present. (Fig. 52.)

Treatment. In many instances the diagnostic results of tracheobronchoscopy will point the way to successful general therapy. This is occasionally true of tuberculosis, but more often of syphilis.

The local treatment of stubborn chronic tracheitis, especially if ulcerative, which is rare, is notably successful.

The endoscopic application of dilute solutions of argyrol, argentic nitrate, balsam of Peru, ichthyol, and iodine gives excellent results. In many instances these applications can be made with the tubular speculum under local anesthesia.

Benign growths of the trachea can be readily removed through the tracheoscope.

It is quite feasible to remove malignant growths originating in the tracheal mucosa, though it is seldom advisable to do so, on account of the rapid repullulation afterward. Adequate removal of a malignant growth is seldom possible.

The tracheal stenosis due to fungating granulations in the trachea at the site of a tracheotomy wound that has been allowed to heal at the skin before the trachea has healed, may be very promptly cured by the endo-tracheal application of a saturated solution of resorcin. Fig. 12,

Plate II, represents such a case. Of course, a better plan is not to allow such a condition to occur, but unless carefully watched, internes are very prone to permit it to happen.

Strictures of the larynx and upper trachea are best treated by thyrotomy, thyro-tracheotomy, or by dilation with tupelo tents followed by prolonged intubation. In one case, (Fig. 4, Plate I,) a high tracheal stricture, due to the erosion of a foreign body through from the esophagus, was dilated with an extubator, and treated by prolonged intubation, with a result of perfect cure.

Strictures of the cervical portion of the trachea associated with loss of cartilage, are probably best treated by tracheoplastic surgery, which

FIG. 52.—Cervical ribs present in a case of deviated trachea and laryngoptosis.

substitutes some rigid material for the lost cartilage. Such methods are, however, strictly limited to the cervical trachea. Below the sternal notch only endoscopic methods are available. Some excellent results have been recorded.

The tracheal cases requiring treatment are those in which the stricture is so small as to interfere with respiration. In the bronchi the cases requiring treatment are those in which there is interference with the passage in and out of the respiratory current, and with the escape of secretions. This condition is recognized by bronchoscopy and by auscultation and percussion.

For dilation of a bronchial stricture the most practical method is von Schrötter's. Obviously it is not adapted to the trachea. With forceps, through the bronchoscope, a laminaria tent (1.5 cm. to 2.5 cm. in length, 4 to 7 mm. in diameter) is inserted in the stricture and allowed to remain for 25 minutes, during which time the thread attached to the tent is allowed to hang out the mouth. The tent is then removed and a metallic tube, like Fig. 53, is inserted. The tubes used by von Schrötter were of aluminum, though he also used German silver and iron, because, being more dense, they cast denser shadows, enabling a better radiographic

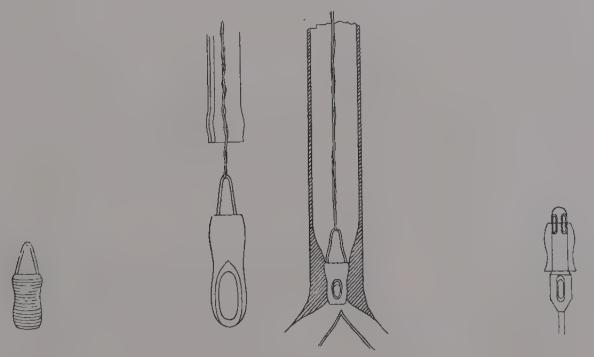


FIG. 53. FIG. 55. FIG. 54.

FIG. 53.—von Schrötter's bronchial intubation tube.
FIG. 54.—von Schrötter's bronchial intubation tube and mandrin.
FIG. 55.—von Schrötter's tracheo-bronchial dilating tube and end of special bronchoscope for introduction.

watch to be kept on the position of the tube. The sizes used were from 3 to 10 mm. in diameter, and 10 to 25 mm. in length, and the weight in some instances was as much as 4 grams. The shape and the encircling ridges prevent expulsion of the tube by coughing. In dilation of strictures of the trachea, a tube with a bail to which a thread was attached was used, the thread being long enough to come out of the mouth or tracheotomy wound. The dilating tubes were inserted without the mandrin used in earlier cases (Fig. 54), using instead a bronchoscope with a dilated end into which the end of the dilating tube telescoped, being held in place by the thread held taut. (Fig. 55.)

The author has devised an attachment for the forceps by which tents may be placed. (Fig. 25.)

CHAPTER VIII.

Tracheo-Bronchoscopy, Upper and Lower, for the Diagnosis and Extraction of Foreign Bodies.

General Considerations. Since Killian startled the medical and surgical world with the announcement of his removal of a foreign body from a bronchus by means of forceps passed through a straight tube introduced through natural passages, the crude and dangerous blind groping in the trachea and bronchi for foreign bodies with forceps introduced through a tracheotomy wound has in enlightened circles, gradually given way to exact methods associated with little risk. It is not meant that the tracheotomy wound has been altogether dispensed with, but instead of groping in the dark, the foreign body is now found and seized under the guidance of the eye.

The relative advisability of upper and lower bronchoscopy. Save where the breathing is bad, it is rarely necessary to open the trachea for tracheoscopy. For bronchoscopy, however, the mechanical manipulations of entering the tertiary and even the secondary bronchi are slightly more difficult through the natural passages. So far as seeing is concerned, if unilluminated tubes are used, it will be found that the length of tube required makes it much more difficult sufficiently to illuminate the object. Ingals states that upper bronchoscopy is rarely satisfactory in children under 3 years of age. If a bronchoscopist of his experience finds it unsatisfactory, the inexperienced will find it useless.

With the light carrier instruments, however, a foot more or less of tube makes no difference, if the observer's eye be normal. The object, whether one foot or two feet away, is always illuminated with the same brilliancy, while, with unilluminated tubes, the intensity of the light diminishes as the distance. With a properly adjusted headlamp and a high polish on the interior of the tubes, the loss is not as the square of the distance, for the rays are nearly parallel.

After a prolonged upper bronchoscopic examination, the larynx will show some irritation, and hoarseness will usually persist for some hours or days, but if no actual traumatism of the cords has occurred, the voice is perfectly regained at the end of a week. Even if some traumatism has occurred the voice ultimately recovers. In one case reported by Nehrkorn, tracheotomy was required for post-bronchoscopic edema, produced by a two-hour examination. Von Schrötter also reports a case of severe laryngeal edema. In general, therefore, it may be stated that it is unwise to persist too long in an upper bronchoscopy. The added risk of a tracheotomy is less than the risks of prolonging the anesthesia, prolonging the shock, and prolonging the abolition of the cough reflex. The possibility of being ultimately compelled to resort to a tracheotomy any way, either from unsuccess, or because of edema of the larynx, should be borne in mind. Edema is unlikely if a small tube be used.

In each particular case, the operator will weigh the personal equation of himself and his patient in arriving at a decision.

Indications.

Tracheo-bronchoscopy is indicated in any case in which the presence of a foreign body in the trachea, bronchi, or lungs is suspected. It is not wise to hesitate because of a lack of certainty of its presence.

Professional opposition to this view will be rarely encountered in these days of safe and easy tracheo-bronchoscopy. Occasionally a relic of the old days of dangerous, and usually fruitless, fishing with hooks and forceps introduced into the trachea and bronchi through a tracheotomy wound, will crop out in the form of an opinion that an expectant plan of treatment is indicated, at least for a time, if not indefinitely. This opposition will arise, in three classes of cases:

1. Those cases in which the history is corroborated by the Roentgen ray.
2. Those in which it is corroborated by the symptoms or the physical signs.
3. Those in which it is not corroborated at all.

It is the author's opinion that in all three of these classes of case tracheo-bronchoscopy is indicated.

It has seemed more convenient to consider the prognosis of the expectant plan under the head of "Dangers."

Results.

Of 94 cases of tracheo-bronchoscopy, upper and lower for foreign bodies, collected statistically for the author, the corpus delicti was found and extracted in 78 or 85.1 per cent.

The cases of failure were those in which:

1. Inorganic substances as pieces of kernels of nuts or grain, beans and the like had swollen and become impacted and buried in a minute bronchus; or, 2. In which there was a stricture above the site of lodgment; or, 3. In which there were such grave symptoms (present before operation) that the procedure had to be abandoned.

Contra-indications.

The author's views are rather radical on the subject, but he does not consider anything an absolute contra-indication to tracheo-bronchoscopy in a patient known to have a foreign body in the trachea or bronchi, as the patient is very much safer without the foreign body than with it, no matter what the condition may be. Of course, should there be doubt as to the presence of the foreign body, it may become a question as to whether the procedure would be justifiable in case of serious diseases such as mentioned under the general subject of contra-indications.

Dangers.

The dangers of tracheo-bronchoscopy in general have been considered in a previous chapter, and they are but little more than those of anesthesia.

Before the days of tracheo-bronchoscopy the physician was confronted with the problem of comparing the dangers of removal with those of leaving the foreign body to nature. To-day when endoscopy has reached such a high degree of perfection, the dangers of removal are exceedingly slight, while the dangers of doing nothing are great. This subject is gone into more fully on a subsequent page.

Pneumonia and bronchitis when they occur are far more likely the result of the condition calling for the tracheo-bronchoscopy than of the procedure itself.

Ingals reports two deaths of obscure pathologic mechanism. One occurred 3, the other 6, hours after the successful removal of the foreign body. He is unable to explain it but suggests the possibility of its being due to the application of adrenalin and cocain, so close to the vagus nerve; or possibly to the chloroform, though this seems doubtful as the anesthesia was of short duration. He also suggests the possibility of secondary surgical shock.

Nehrkorn and von Shrötter each report a serious laryngeal edema, requiring tracheotomy after upper bronchoscopy. This edema is an element of danger if the patient is discharged immediately after extraction. Kept in the hospital there is no danger other than that of tracheotomy, should this become necessary.

The risk of lower bronchoscopy independent of that of the tracheotomy is exceedingly slight if done gently and at once after the tracheotomy. If delayed until the tracheal wound becomes infected, the danger of carrying in septic material increases the risk materially. In lower tracheo-bronchoscopy, the risk of tracheotomy, independent of the condition calling for it, is not over 2 per cent. Tracheotomy here must not be considered in the same light as when done for diseased conditions. The latter have an extra risk in the primary disease and in the usual postponement of tracheotomy until the respiratory and cardiac centers are poisoned with carbonic acid, and the resisting power of respiratory and other organs is dangerously weakened.

One danger that can be avoided is putting tracheotomy off, until the patient has ceased to breathe. Then a moment's delay in the opening of the trachea may be fatal through cardiac arrest. Respiratory arrest is not dangerous after the trachea is opened, but cardiac arrest is usually fatal. Respiration often cannot be started unless the trachea be opened. All of these dangers are avoided by preliminary tracheotomy and lower bronchoscopy. The operator's ability to stab the trachea in a moment when necessary will govern the risk. In a few of the author's earlier cases of tracheoscopy, tracheotomy had to be done to start respiration which had stopped apparently from respiratory inhibition.

The hints given under tracheotomy if followed will minimize the risks of opening the trachea.

Tracheal varicosities might be an element of danger did they exist in a foreign body case. The author has seen several instances of these lesions unassociated, however, with a foreign body. Should they exist they are readily seen and injury to them readily avoided by careful manipulation of the tube.

The dangers of leaving the foreign body alone, in these days of perfected endoscopic technic do not merit lengthy consideration. But as the relative gravity of prognosis will arise in nearly every case, and occasionally a relic of the days of blind groping in the dark, will be encountered in opposition to tracheo-bronchoscopy, the dangers of the "let alone" plan require mention. They are, briefly, bronchitis, bronchiectasis, pneumonia, abscess, gangrene, cirrhosis, pneumothorax, and possibly tuberculosis. The dangers are, therefore, immediate or more or less remote.

The degree of danger, of course, varies with the nature, shape and size of the foreign body, its position and the condition of the patient.

The shape and size will determine the depth of penetration and the probability of excluding air from the pyramid of lung tissue supplied by the occluded tube. Rounded objects are particularly prone tightly to fit a bronchial tube, excluding air and producing gangrene and abscess.

Rough or pointed objects are prone to cause trauma either by being coughed back and forth or by erosion from a prolonged sojourn in one position. Either of these conditions is apt to be associated with infection, and prolonged irritation ending in fatal exhaustion. Occasionally, an abscess may discharge spontaneously into a bronchus, the foreign body being also expelled in some instances, in others, not.

Inorganic substances are prone to swell, macerate and decay, usually causing sepsis. The cooked kernels of nuts, especially peanuts, may, as shown by Claytor, macerate in about a month sufficiently for the pulp to be coughed up. During this time, the risks of bronchitis, pneumonia, and gangrene and sepsis are run. Kernels of nuts and grain, if uncooked, do not macerate sufficiently to be coughed up and their swelling fixes them, so that they are not dislodged by coughing unless they slough out.

In regard to sepsis, there are two factors to be considered. The infection carried down with the foreign body, as for instance, a decayed tooth; and infection by organisms occasionally present in the trachea and larger bronchi. The latter are the least to be feared. Several instances of the former variety of infection have fallen under the author's observation. One was that of a girl, 12 years of age, who had aspirated into her right lung part of a carious incisor broken off in a fall. The author's urgent advice of immediate bronchoscopy was opposed by the family physician, who had many years before seen a death from blind fishing through a tracheotomy wound; and subsequently, a recovery from the "let alone" method. The child who had aspirated the tooth died of septic pneumonia about a week after the accident.

In the prognosis of aspirated bodies we must consider the possibility of asphyxia from loosening of the foreign body and its being cast, by coughing, violently up against the subglottic portion of the larynx and thus causing asphyxia from spasm; and also the possibility of its causing asphyxia by being fixed in the upper portion of the air tract.

It is exceedingly rare for a foreign body larger than a millimeter or two in size to become encysted.

The first 24 hours is the period during which expulsion is most likely to occur, if at all. By the end of that time it is so buried in the swollen mucosa that it is seldom expelled until after sloughing has occurred.

Statistics are against the "let alone" method. Roe collected 1417 cases of foreign body in the air passages, in which no extraction was attempted. There was a mortality of 27 per cent. It may be argued that these statistics do not include many cases in which a small object was inhaled and shortly thereafter coughed up again. In the author's opinion, this is fully counterbalanced by the numerous cases where a small child, unable to talk, or forgetting to tell of it, has aspirated a small foreign

body and died of pneumonia or other complication, the true cause of which never was suspected.

Of 94 cases of bronchoscopy, upper and lower together, collected for the author, 9 died, making a mortality of 9.6 per cent. Eliminating six that were in bad condition and probably would have died without operation, the mortality may be placed at 3.2 per cent. The author would feel inclined to place it at less than this were it not for two mysterious deaths reported by Ingals, where in 3 and 6 hours respectively, after removal of a foreign body the patient unexplainably sank and died.

Summing up, the prognosis of tracheo-bronchoscopy is good if the operation be not postponed until the patient's condition has become serious. In cases where the general condition is serious the prognosis is not so good as in cases in better condition, yet the ultimate prognosis is better with the operation than without.

Other things being equal, the prognosis is the better the sooner the foreign body is extracted.

In conclusion the author's opinion is that we do full justice to our patients when we tell them that while the foreign body may be coughed up, the chances of this are remote and it is very dangerous to wait; and further, that the difficulty of removal increases with each hour the body is allowed to remain.

Symptoms.

Cough. This is the most constant symptom of foreign body in the air passages. It appears as an immediate symptom in the effort to prevent the entrance of the body at the laryngeal orifice, and later, in more or less paroxysmal efforts to rid the air passages. Later still cough is present from the inflammatory reaction to the irritating presence of the invader. This later cough is more apt to be constant than that which occurs earlier. The early coughing is usually paroxysmal some minutes or hours elapsing between the seizures. These intervals may be entirely quiet, but are often attended with an occasional cough which interrupts the sleep of exhaustion.

Dyspnoea is a very frequent symptom. It is usually inspiratory in character, but may be expiratory or both. It may be due to actual obstruction to the passage of air by the presence of the foreign substance itself, or by the bulk of the body plus the resultant swelling and secretions; or it may be due to the air hunger from the diminished mucosal surface reachable by air. The dyspnoea is always worse during the paroxysms of coughing, at which times it may reach unconsciousness from carbonic acid narcosis.

It is worth while bearing in mind that dyspnoea may be present in a case where the foreign body is in the esophagus, but is eroding through.

as in a case of the author's, elsewhere reported in this book, or by displacement of the trachea due to its bulk.

The temperature is usually elevated which is often misleading, and in cases of doubtful diagnosis will be erroneously advanced as negative evidence, and urged against a diagnosis of foreign body. It may be, in the early stages, irritative. Later it is toxemic due to septic absorption from a localized inflammatory area. It may be due to the complications as pneumonia, bronchitis, etcetera.

Chills are often present. They are due to the same causes as the elevation of temperature, together with which, especially in abscess cases, they may closely simulate pulmonary tuberculosis.

Hemoptysis is not very constantly present, but when it occurs, it is a valuable symptom. Blood most frequently occurs as streaks or clots in the expectoration; only in case of very sharp bodies is it in any amount, and is then dependent on the accident of cutting a small vessel.

Pain is often noted but it is apt to be vaguely localized and may be due to tissue soreness due to violent coughing.

Diagnosis.

The Roentgen Ray. In all cases even in those where there is little hope of the foreign body showing opacity to the ray, a radiograph should be taken if the conditions are not urgent. If there is very urgent dyspnoea, there should be no delay, not only on account of the urgency, but because the dyspnoea itself is an indication that the foreign body is in the larynx or trachea, or at any rate not lower than a main bronchus.

The fluoroscope is not reliable as, unless quite dense, the corpus delicti will not be seen. A radiograph should be made in all instances and should be interpreted by the Roentgenologist, as few others see a sufficient number of radiographs, normal or abnormal, reliably to interpret the plate. Even then mistakes, both negatively and positively, are apt to occur occasionally.

The production of the radiographic shadow by a foreign body is a matter of the density of the foreign substance.

This should be remembered when deciding whether the substance of which there is a history in the particular case would show radiographically or not. Metallic substances with the exception of aluminum usually show clearly. Aluminum will only show when of some little bulk, and on a radiograph, not upon a fluoroscopic screen. Pewter and lead usually throw dense shadows. Fig. 57 illustrates how clearly a cast pewter shirt button in the trachea was demonstrated radiographically, in an infant referred to me by Dr. Day. The child was turned partly sidewise to endeavor to prevent the shadow of the foreign body overlaying that of the

FIG. 56.—Bone in bronchus of maiden of 18 years.

FIG. 57.—Pewter shirt button in the trachea of an infant.

vertebræ—an unnecessary precaution in this case on account of the very dense shadow cast by the alloy of lead.

Inorganic substances other than metal, such as pebbles, toy marbles, glass, and the like, usually show well.

Organic substances, such as bones, containing considerable quantities of earthy salts, usually show well if not overlying the bones of the patient, especially the vertebrae.

The particular bone in question has much to do with the decision. The hard dense bones show best, the semi-cartilaginous bones least, bulk for bulk. If it is a question of fish bone, the determination of whether it is a vertebral or rib bone is of value. Rib bones of the fish, cast almost no shadow and even the vertebral bones as a rule will not show unless of good size and not overlying the patient's denser bones. Fig. 56 is from a radiograph which shows clearly a small fragment of bone in a secondary bronchus. Had the bone been less dense, or had its position overlaid the vertebral column or even a rib, or had the radiograph been poor this bone would not have shown, and the author would not have had permission to remove it.

Vegetable substances as a rule do not show well, unless quite dense, as some kinds of woody fibre.

Various nut kernels within the thorax are not easy to demonstrate radiographically. Some of them are not very important as they are apt to macerate and be coughed out. This is more especially true of the cooked kernels, such as peanuts and chestnuts. The shells or hulls of hard-shelled nuts usually throw radiographic shadows.

In all this work, it is important to have the very best possible radiographic technic. With a history of a metallic body, and in an unruly, terrified child, it is usual to make too short an exposure, and to fail to hold the child still. This usually suffices, but is of little value if negative. In rare instances, it may, as pointed out by Mosher apropos of one of the author's cases, be dangerously deficient in not showing other conditions such as a hypertrophic thymus gland, that might be the cause of the symptoms wrongly attributed to the supposed foreign body.

In few cases is it wise to decline endoscopically to examine a patient because the radiograph shows nothing. Only in the case of a metallic or other dense substance failing to show upon a technically good radiograph should we reassure ourselves and patient that nothing is present. Even in such cases, if there are any symptoms to corroborate the history, it is safer to tracheo-bronchoscopize, and, usually, either the cause of the symptoms, be it foreign body, traumatism, lesion or neurosis, will be discovered; or the absence of such cause will be positively demonstrated.

An otherwise unexplainable dyspnoea, especially if intermittent and

unassociated with fever, is almost diagnostic of foreign body in the air passages.

As a matter of fact, however, fever is nearly always present, except in the early stages. So much so that with the chills, cough, and expectoration, there is no doubt that many a case of abscess from a foreign body has gone to the grave labelled erroneously with the diagnosis of tuberculosis. Usually the persistent absence of bacilli in the sputum will decide. But it must not be forgotten that a foreign body abscess may be or become tubercular. The author has seen one such case. In addition it must not be forgotten that a tuberculous subject may, as well as anyone, inhale a foreign body. Of this also the author has seen one case, a girl of 18 years who, in taking a deep inspiration after a sudden coughing paroxysm at table, aspirated a small piece of beef bone. The radiograph was doubtful (by some the shadow being thought to be the shadow of a vertebral process, Fig. 56), and it was some time before the author was permited to remove the bone from a secondary bronchus.

Physical signs are of value diagnostically if done, not by a laryngologist, but one who is accustomed to auscultatory and percussive work. In other words, one who has educated his ear. Perhaps, the most value will attach to the physical signs as indicating which side the foreign body is on, especially in a case of a negative radiograph. This is an important part of the diagnosis, often saving time by indicating which side to search first; though in no case should this lessen the necessity of examining the other side in case of failure to find the corpus delicti, which may have in the meantime been coughed up and re-aspirated into the other side.

The following notes prepared at the request of the author by Dr. John W. Boyce, will be found exceedingly valuable.

The physical signs are as a rule illy reported in published cases, and seem to have been studied with but scant interest. They are apparently insufficient for diagnosis. Frequent cases of serious lung trouble are explained and terminated by the coughing up of an unsuspected foreign body, but I can find no instance in which the diagnosis was made in the absence of history. Yet the findings in physical examination are occasionally quite distinctive, and very frequently of use in localization. It is to be hoped that wider use of the X-ray and of modern methods of exploration will not overshadow auscultation whose full value has certainly not been exploited as yet.

In the examination a distinction must be made between those signs due simply to the presence of the foreign body and those due to the inflammatory accidents which rapidly follow.

In the classic period of auscultation, two pathognomonic signs were described; a laryngeal click due to body fixed in the larynx, "the bruit of the standard" (resembling the flapping of a flag in the wind) caused by a body loose in the trachea. It has not been my fortune to observe either of these nor are they mentioned in recent literature, possibly because bodies in these

localities are so easy of diagnosis or the operative indication is so plain and urgent as to forestall careful examination.

A body obstructing the bronchus may lead to atelectasis of the lung with the ordinary signs of this condition. This occurrence is not so frequent, however, as is generally supposed. The most common finding is a marked local diminution of the respiratory murmur together with preservation or accentuation of the normal resonance and this may be rated as the typical condition in foreign body cases. When a body partially obstructs the bronchus it may give rise to a peculiar dry rale, easily distinguished in quality from that of inflammatory or tubercular thickenings of the mucous membrane. Even were this distinctive quality lacking it is scarcely possible for inflammatory conditions to produce dry rales, limited always to a particular area and remaining unchanged for hours at a time. Such a condition would seem to justify exploration. The case of Infant J., which I have reported, furnished an example of a whistling rale heard over one cone of lung in which the respiratory murmur was first diminished and later replaced by moist rales due to the consecutive bronchitis.

Of consecutive inflammatory conditions, the most common and earliest is a moist localized bronchitis. Unfortunately the secretions of the diseased area are apt to be inspired into normal bronchial tubes and so when the case first comes under observation we may find the signs of diffuse bronchitis. Even so it is to be remembered that diffuse bronchitis, with very bloody expectoration, coming on suddenly, is a most unusual condition and would produce shock or septic phenomena with less prominence of dyspnoea and cyanosis. Expectoration in foreign body cases, is usually bloody and has a great tendency to become free, purulent, and fetid. The diagnosis usually made in these cases is that of tuberculosis; but systematic examination of the sputum should guard against error. If localized abscess, gangrene or pneumonia of lobular type results, it is indistinguishable by physical signs from similar conditions due to the more ordinary causes. Lobar pneumonia sometimes occurs. One most interesting case, reported by Ingals, gave a typical picture of pleural effusion and two attempts at tapping had been made before the case was referred for bronchoscophy.

It is very evident that auscultation for localization may be useful as a preliminary to bronchoscopy. It is perhaps too much to hope that the presence of foreign bodies will ever be diagnosticated by this means alone, but should often lead to suspicion. "Tuberculosis" without bacilli in the sputum, particularly if located towards the base of the right lung; unilateral or unilobular bronchitis; more particularly if hemorrhagic or fetid in character; atelectasis abscess or gangrene not otherwise explainable—these conditions should suggest the possibility of the presence of foreign body in the bronchi.

The most likely point of lodgment of a foreign body depends somewhat upon its form and surface. Smooth round bodies usually lodge in the smallest bronchus that will admit them, stopping at a bifurcation or, rather, the giving off of a lateral branch. Pins, tacks, and nails are likely to drop head downward into a small bronchus. Safety pins, unless closed, rarely get into the air passages.

The radiographic localization as to the particular air passage invaded

has been touched upon when writing of the anatomy of the tracheo-bronchial tree.

Technic.

There is little to add to what has been said previously on the general subject of technic, save in regard to the use of the forceps, hooks, et cetera.

The chief difficulties other than those previously enumerated arise in the case of very small bodies very deeply located in small bronchi, especially if macerated and embedded in the swollen mucosa.

In working near the periphery, with unilluminated tubes, it may become impossible to work by sight, as the forceps shut off what little light enters. The forceps have to be passed blindly, reliance being placed upon memory of the previously observed position of the foreign body. A mark must have been previously placed upon the forceps canula to show when the point of the forceps has reached the distal end of the tube. The sense of touch is not of much aid even in case of metallic foreign bodies for contact of the forceps with the tube gives a confusing sensation of metallic contact. In case of a soft foreign body, the sensation would be no different from touching the mucosa. Ingals, who has done some of the most brilliant work, always inserts and uses the forceps without light.

In the trachea and larger bronchi of adults, there are no difficulties other than those previously mentioned. The use of forceps through the large tubes is not difficult, especially if illuminated tubes are used. In children under 3 years of age the small tubes used render the procedure more difficult, though the shorter length of tube required is some compensation.

Variously shaped hooks are often of use in turning over foreign bodies into a position where they can be seized with the forceps, and occasionally they may afford sufficient hold entirely to remove the foreign substance. They are passed flat until below the intruder, then rotated so as to come up below it, when they are withdrawn until they come in contact with it. Fully curved hooks must be used cautiously lest they get caught in a bronchial orifice.

In case of hollow foreign bodies the expanding forceps (Fig. 21) will be found of service if it can be inserted into the hole in the intruder, which is then held by expansion of the forceps in somewhat the same manner as is an intubation tube in the extubator. It is not intended to be screwed into the foreign substance as might be inferred from its appearance. It is roughened to lessen the likelihood of its slipping.

Usually outcoming exudate or secretion will indicate the bronchus invaded; or if the foreign body has been in for sometime, inflammatory signs will indicate. In one of the author's cases the orifice was swollen shut, but the intruder was felt beyond with the probe and removed.

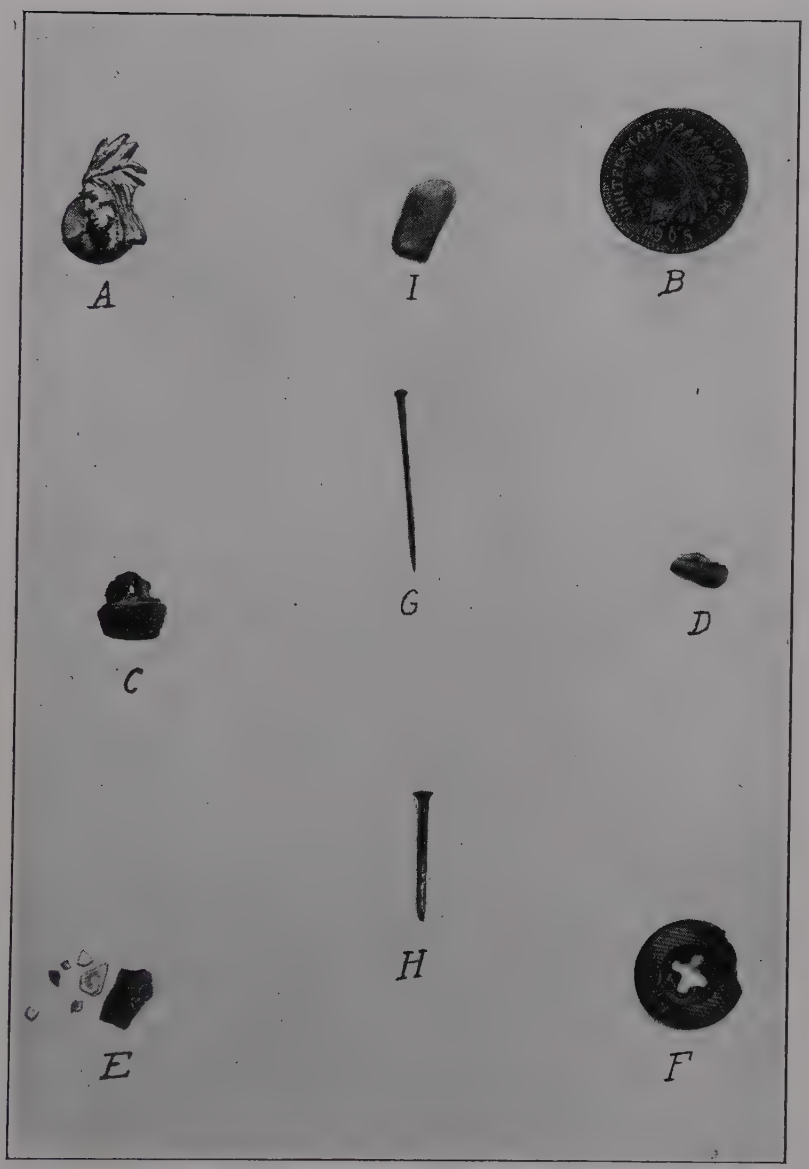


FIG. 58.—Foreign bodies from the air passages.
(From the author's collection.)

A, Shirt button from trachea of 19 year-old boy. Cocain. Upper tracheoscopy.

I, Pebble from left bronchus of man of 28 years of age. Ether. Upper bronchoscopy.

B, Penny, which in 2 months ulcerated through into trachea from esophagus. 2 year-old child. Chloroform.

C, Shoe button in bronchus 2 years. Maid of 18 years. Upper tracheoscopy.

D, Bone from bronchus, maid of 18 years. Upper bronchoscopy. Chloroform.

G, Pin from trachea of woman aged 20. Upper tracheoscopy. Chloroform.

E, Fragments of egg shell from larynx. Symptoms simulated croup; antitoxin given. Infant 9 months old. Direct laryngoscopy. No anesthesia.

H, From right secondary bronchus, man aged 24 years. Upper bronchoscopy. Chlorcform.

F, From trachea. Boy 14 years of age. Cocain.

Part II.

ESOPHAGOSCOPY.

CHAPTER IX.

Esophagoscopy.

Introduction.

By esophagoscopy is understood, at the present day, the examination of the esophagus with the aid of tubes introduced through the mouth. By retrograde esophagoscopy is meant the examination of the lower end of the esophagus, with the aid of tubes introduced upward from below through a celiotomic wound.

In dealing with this subject, to avoid iteration, the difficulties, dangers, contraindication and much of the technic will be deferred for subsequent consideration along with the same topics under "Gastroscopy."

The use of the flexible esophageal bougie has no place in this book, and, in the author's opinion, it has no place in the advanced surgery of the esophagus. In remote localities, where no other instrument is available, it may, as a makeshift, yield information otherwise unobtainable, and may serve slightly to open a stricture, but its use is attended with great risk, because the end is beyond control. Instruments passed by sight with the aid of the esophagoscope are alone permissable.

It is not possible within the limits of this manual to attempt the consideration of diseases of the esophagus. Only a few of the more frequent conditions will be considered, and these but briefly.

CHAPTER X.

Anatomical Notes on the Esophagus.

It is not intended to go into the anatomical details, but there are a few points in the gross anatomy of the esophagus that must be borne in mind in the passage of rigid straight instruments down its lumen.

Dimensions.

Length. The wide and bewildering differences in the length of the esophagus as given by different authorities are due to:

1. Different anatomical points from and to which measurements are taken.

2. Observations in some instances upon the cadaver, in others upon the living, yielding differences due to:

3. The elasticity of the esophagus, which is greater in the living than in the dead subject, and which permits of extension and displacement.

4. The movements and displacements of the esophagus.

5. Anatomical variations which are, with few exceptions, wider than in any other organ in the body. Besides anomalous variations, there are those more or less regular, corresponding to age, sex, height and body weight.

To go at length into these variations in dimensions would be out of place in a practical manual. The practical working lengths are those taken from the upper teeth as a starting point. The following table compiled from Stark by Mosher is convenient:

Length of the Esophagus at Different Ages.

Teeth to Cricoid.	To Bifurcation.	To Cardia.	Length of Whole Esophagus.
Birth, 7 cm. (2¾ in.)	12 cm. (4¾ in.)	18 cm. (6¾ in.)	10 cm. (4 in.)
1 year, 10 cm. (4 in.)	14 cm. (5½ in.)	22 cm. (8¾ in.)	12 cm. (4¾ in.)
2 years, 10 cm. (4 in.)	15 cm. (6 in.)	23 cm. (9 in.)	13 cm. (5⅛ in.)
5 years, 10 cm. (4 in.)	17 cm. (6¾ in.)	26 cm. (10¼ in.)	16 cm. (6⅜ in.)
10 years, 10 cm. (4 in.)	18 cm. (7 in.)	28 cm. (11 in.)	18 cm. (7 in.)
15 years, 14 cm. (5½ in.)	23 cm. (9 in.)	33 cm. (13 in.)	19 cm. (7½ in.)
Adult, 15 cm. (6 in.)	26 cm. (10¼ in.)	40 cm. (15¾ in.)	25 cm. (10 in.)

The diameter of the esophageal lumen is subject to relatively greater variations than its length. It is not at any point a definite dimension owing to the elasticity of the esophageal wall. For practical purposes, however, it is only necessary to consider its diameter at the four points of constriction.

Mosher's compilation from Stark is practical.

DIAMETERS OF THE ESOPHAGUS AT THE FOUR CONSTRICTIONS.

Constriction.	Diameter.	Vertebra.
Cricoid	Transverse 23 mm. (1 in.) Antero-posterior 17 mm. (¾ in.)	Sixth cervical
Aortic	Transverse 24 mm. (1 in.) Antero-posterior 19 mm. (¾ in.)	Fourth thoracic
Left bronchus	Transverse 23 mm. (1 in.) Antero-posterior 17 mm. (¾ in.)	Fifth thoracic
Diaphragm	Transverse 23 mm. (1 in. +) Antero-posterior 23 mm. (1 in. —)	Tenth thoracic

For esophagoscopic purposes the most important constriction is at the introitus. This has already been described.

The next constriction in point of importance is at the hiatus esophageus. The opening in the diaphragm, which goes by this name, (Fig. 59), is subject to wide variations dependent upon the state

FIG. 59.—Under surface of the diaphragm.
E, Hiatus esophageus. Note the direction of its axis.
A, Aortic opening.
VC, Opening for vena cava. Note direction of tendons and muscular fibers.

of the diaphragmatic muscular fibres, whether these be in a state of relaxation, normal contraction, or spastic rigidity. These are important points to bear in mind. The axis of the lumen at this point, (Fig. 59) should be memorized, as it is exceedingly useful to know in passing the esophagoscope and gastroscope.

Between the two constrictions just mentioned are two others of lesser importance. They are often not noticed, unless watched for closely. The upper of these being the second constriction from above downwards, corresponds to the arch of the aorta, opposite the fourth thoracic vertebra, back of the manubrium sterni. This is often exaggerated in esophagoscopy by the active pulsation of the aorta, due to excitement or to morphin or ether stimulation.

The other constriction, being the third from above downward, corresponds to the crossing of the left bronchus in front of the esophagus, at the level of the fifth thoracic vertebra.

All of these constrictions are distensible, the upper one, at the introitus, less so than the others. The extreme elasticity of the esophageal walls permits of stretching the normal adult esophagus to over two centimeters without rupture, though this is not available for esophagoscopy. For practical purposes it is only necessary to remember that in a normal esophagus the following sized rigid tubes should pass freely:

Infants	7 mm.
Adults	10 mm.

Considerably larger tubes may be used in many cases, but in all cases where these cannot be passed, stricture, spasmodic or anatomic, exists. Flexible bougies of 8 mm. diameter, should pass in infants and children up to ten years of age, and in adults 14 mm. should pass. Though for reasons given elsewhere the author disapproves of the use of the bougie

Position. Beginning at the level of the bifurcation of the trachea, the gullet curves around the aorta decendens, to the left of which it passes through the hiatus close to the vertebræ.

The subphrenic portion of the esophagus which deviates to the left has a certain range of mobility, amounting to, apparently, 10 or 15 centimeters in relaxed persons of spare build. It is apparently attached to the surrounding tissues by loose cellular tissues. It is this mobility which renders it possible to introduce a straight and rigid gastroscope which straightens out the curve and the deviation of this subphrenic portion of the esophagus.

In studying the gross anatomy of the esophagus, the first essential point to remember is that the esophagus is never twice alike, not only in different individuals, but in the same individual at different moments. The only really fixed point is at its junction with the posterior pharyngeal wall. All other portions are subject to various movements, intrinsic and those imparted by contiguous structures. The intrinsic movements are those of deglutition and its reverse regurgitation. The extrinsic or transmitted movements are respiratory and pulsatory. The respiratory movements

are noticed chiefly in the thoracic esophagus, and consist in a dilatation, or opening up, of the esophageal lumen due to the negative intra-thoracic pressure.

The normal pulsatory movements are aortic and cardiac, due to the pulsatile pressure of the aorta at the level of the fourth thoracic vertebra, (24 cm. from the upper teeth in the adult), and of the heart itself noticed most markedly at about the level of the seventh and eighth thoracic vertebræ (about 30 cm. from the upper teeth in the adult). These movements vary greatly within the limits of health.

The intrinsic movements of the esophagus are involuntary muscular contractions, as in deglutition, and regurgitation; and spasmodic, the latter usually having some pathologic relation.

The presence of a sphincter at the cardia has been much discussed. Anyone who has carefully observed cardio-spasm must admit that it indicates the presence of the two layers of muscular fibres surrounding the cardia as described by Hyrtl. Yet the author feels inclined to the belief that the prevention of regurgitation of food up the esophagus is due largely to a kinking of the esophagus upon itself at the hiatus diaphragmatis increased by expansion of the stomach when dilated with food. Whether this be true or not remains to be proven. But in examinations the author has frequently noticed this kinking, even when the stomach was empty.

CHAPTER XI.

Normal Esophagoscopic Appearances.

The form of the esophageal picture changes in various portions of the tract.

The introitus esophagi is closed by the constriction produced mainly by the inferior constrictor of the pharynx, producing a backward pressure of the cricoid cartilage, which, at all times except during the act of swallowing, lies in contact with the posterior pharyngeal wall.

The form of the cervical portion of the esophagus is a transverse slit due to the collapse of the walls from before backward, it opens up ahead of the tube in a way that shows a more or less flat anterior and posterior wall, meeting at the sides. This opens and closes, often audibly, with the respiratory movements. Upon entering the thoracic esophagus, the esophagoscope reveals a more or less oval or quadrangular opening into the depths of which the observer looks. (Fig. 2, Plate III, and Fig. 1, Plate IV.) This opening is very much smaller than the entire esophageal lumen, and it increases very much with each inspiration, lessening but not completely closing with expiration. The position of this opening changes as the esophagoscope, during insertion, is deviated to one side or the other, and in case of great deviation it may disappear altogether, the flat wall only being in view.

At the hiatus diaphragmatis the form of the lumen again becomes a slit, the axis being placed obliquely from the right posteriorly to the left anteriorly. (See Fig. 3, Pate III, and also Fig. 59 in the text.)

The subphrenic portion of the esophagus is usually opened but slightly by respiratory movements, and is at times collapsed by movements of the diaphragm and the abdominal viscera. The observer is prone to consider it collapsed when really the fault is in the gastroscope not following the axis of the esophageal lumen.

Folds probably do not exist in the quiescent state of the esophagus. When muscular contractions occur, folds probably exist. Of these things there is no absolute certainty. When a tube is introduced, however, the

wall may be thrown into folds, either transverse or longitudinal. There has been much useless discussion upon this point, one observer seeing one kind of folds and another observer another kind. In most instances, in the author's opinion, the folds were produced by the manipulation of the esophagoscope.

The color of the normal esophageal lumen varies greatly in different individuals, in the same person at different times, and still more greatly does the apparent color vary with the form of illumination. With the bright white light of the self-illuminated tubes, the mucosa is almost white, shading to pale grayish pink. With reflected sunlight which the author used experimentally to determine the color, the mucosa seemed to be of about the same tint. With the unilluminated tubes the color varies with the amount of light that reaches the mucosa. If well illuminated, the color is the same as with the illuminated tubes. If poorly lighted up, the mucosa seems dark red or brown. The colors as given here refer to the perfectly cleansed mucosa. Overlying secretions vary the tint greatly; so also may drugs, as chloroform, ether, cocain, etc. The surface of the mucosa is moist and glistening. In the cervical and the abdominal portions minute vascular twigs are at times seen. They are less often noted in the thoracic portion in health. A fair idea of the appearance of the normal esophageal mucosa may be conveyed by comparing it to the mucosa of the inside of the cheek.

CHAPTER XII.

Technic of Esophagoscopy.

Examination of the Upper End of the Esophagus.

The examination of the upper end of the esophagus is a very easy matter. Technically it is the same as direct laryngoscopy, (q. v.) but it is much easier of accomplishment by the inexperienced. It may, and should, be a routine procedure in the consulting room. A full operating room detail is not necessary. The patient is told to arrive with an empty stomach and a clean mouth. The positions of patient, assistant and nurse and apparatus are exactly the same as described for direct laryngoscopy.

The pharynx and introitus esophagi are cocainized with the aid of a Sajous, curved, laryngeal sponge forceps. The tubular speculum is then passed down back of the tongue until the epiglottis comes into view. It is wise, usually, at this point to take a straight applicator dripping with a 10 per cent cocain solution and cocainize the epiglottis and then, passing on, to cocainize the laryngeal orifice and the introitus esophageus, waiting a few minutes for anesthesia to supervene.

The tubular speculum is passed down back of the epiglottis which is lifted forward against the base of the tongue. This brings into view the arytenoids which are seen to lie in contact with the posterior pharyngeal wall. (Fig. 1, Plate III, shows this as seen in the dorsally decumbent patient. To get the view as seen in the erect patient, invert the plate.) There is no slit; only a depression is seen. The spatular end of the tubular speculum is inserted in this slit, far enough to reach below the arytenoids and engage posteriorly to the cricoid cartilage, which is lifted forward, thus exposing the pyriform fossæ. (Fig. 60.) The lifting forward of the cricoid cartilage exposes the upper esophageal lumen as seen in Fig. 6, Plate III.

Passing the Esophagoscope.

Preliminary to the passing of the esophagoscope for any cause whatsoever, the tubular speculum should be used; not as a guide through which

to pass the longer tube, as in tracheo-bronchoscopy, but to gain a knowledge of the conditions, normal or pathologic, of the upper end of the esophagus. This will prevent the danger of pushing the longer tube into a lesion, or prevent the unnecessary deeper search for a highly located foreign body. Furthermore, examinations should be thorough and thoroughness is only accomplished by a routine examination of all the structures seriatim from above downward. Thus, not only is all chance of

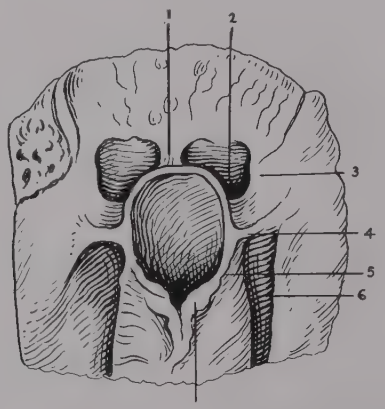


FIG. 60.—Base of the tongue and upper border of the normal larynx, viewed from behind. 1, Median glosso-epiglottic fold. 2, Right glosso-epiglottic fossa. 3, Lateral glosso-epiglottic fold. 4, Pharyngo-epiglottic fold. 5, Aryepiglottic fold. 6, Right pyriform sinus, by way of which esophagoscope should be passed.

missing anything avoided, but we reduce the dangers of esophagoscopy almost to naught, by seeing and avoiding penetration or even abrasion of all weak places in the esophageal wall.

The manipulations of passing the esophagoscope are exactly the same as those of passing the gastroscope and to save repetition they will be given in the chapter devoted to that subject.

CHAPTER XIII.

Diseases and Anomalies of the Esophagus.

Anomalies.

Various congenital anomalies of the esophagus occur, but their extended consideration would be out of place here. The esophagus may be bifid, or the esophagus may end in a blind imperforate pouch. In either case the child seldom lives any length of time. Esophago-tracheal fistula is a form that occurs, and some such cases have been known to live. In one such case, a valve-like fold of mucosa seemed to close the fistula so that no food escaped into the trachea.

Diseases of the Esophagus.

Diseases of the esophagus may be divided into stenotic and non-stenotic classes. Stenotic diseases may be classified into acute inflammatory, neoplastic, spastic and compression stenoses.

The non-stenotic diseases include diverticula, diffuse dilations, paralyses and pareses, and inflammations and ulcerations.

In all of these diseases the esophagoscope stands ready to lend invaluable aid for the purposes of diagnosis and treatment. But, separately to consider all these diseases would far exceed the scope of this manual. Only a few of the many subjects in this interesting field will be considered and only briefly.

CHAPTER XIV.

Stenotic Diseases of the Esophagus.

Acute Inflammatory Stenoses.

Acute inflammatory stenoses must be approached with great caution. As a rule, when they are due to a corrosive, as lye, or carbolic acid, it is better not to pass an esophagoscope, but to wait for the inflammatory reaction to subside. So, too, in traumatic cases, when the implement of traumatism has been removed, it is better not to intrude any instrument. Better results will be obtained by waiting a week or more for the acute inflammation to subside. An esophagoscopic examination then will enable the determination of a plan of treatment to prevent the formation of a cicatricial stenosis. If, however, when first seen, the foreign body, missile, or implement of traumatism is still present, immediate esophagoscopy is imperatively demanded. After removal the trauma is best let alone for a few days until the granulation tissue has made esophagoscopy safe and associated remedial measures effective.

Cicatricial Stenoses.

Cicatricial stenoses are commonly due to post-operative, traumatic, escharotic, luetic, or ulcerative scars.

The diagnosis of the presence of the stricture is readily made esophagoscopically, though the history must be relied upon to determine the etiology.

Post-operative cicatricial stenoses are usually in the cervical portion, as intrathoracic surgery of the esophagus is as yet rarely attempted. The author has seen a number of cases of post-operative esophageal stenosis of the cervical esophagus follow total laryngectomy. It has been known to follow thyrotomy for malignant disease, though it would seem that the proper limits of thyrotomy had been exceeded in such cases. In excision of malignant disease of the glands of the neck, the esophagus has been resected for involvement, with resultant stricture.

Of traumatic stenoses, the most frequent forms result from penetrating gunshot wounds, and from swallowing sharp foreign bodies, as glass, knives, dentures, etc.

Escharotic cicatricial stenoses are perhaps the most frequent. In the days of home made soap, swallowing of caustic soda and potash in the form of lye was not an infrequent accident to children.

Syphilitic ulceration of the esophagus is much more frequent than generally supposed, and the author has seen a number of cicatricial stenoses from this cause.

Of the ulcerations, other than luetic, that may be followed by cicatricial contraction, those of typhoid fever may be cited. One such case was seen by the writer, though it occurred in a case with an escharotic history.

Mr. H., aged 18 years, was referred to me by Dr. A. M. Stevenson for a diagnosis of the esophageal condition. During the fourth week of typhoid fever it was found that there was increasing difficulty in swallowing the liquid food. Finally a stage was reached where nothing but ice cream would pass down, and fully two-thirds of it were regurgitated. Upon passing the esophagoscope, an old hard cicatrical stenosis was found. Upon its edge there was an ulcer of linear form, long axis longitudinal. The old cicatrices (Fig. 4, Plate III.) were also longitudinal giving a radiating arrangement, when viewed through the esophagoscope. Applications of argentic nitrate were made at intervals and resulted in a complete cure of the ulcer, though the difficulty in swallowing persisted for a long time, eventually, however, recovering. Upon close questioning, Dr. Stevenson elicited a vague history of swallowing lye in childhood, followed by some swallowing difficulty which soon disappeared. For 14 years there had been no trouble in swallowing any and every kind of solid or liquid food, until the attack of typhoid fever.

The treatment of cicatricial stenosis with the aid of the esophagoscope has yielded very satisfactory results in many cases of a class formerly condemned to gastrostomy. The passing of bougies blindly, which formerly was the chief method of treatment, is now only used for the maintenance of a dilation accomplished esophagoscopically. Bouginage was a dangerous procedure in the absence of any definite information as to the endoesophageal conditions present in a given case. In the absence of an esophagoscopic examination, when a bougie is blindly introduced and meets with an obstruction, there is no means of knowing whether it has encountered a stricture or the bottom of a diverticulum. Obviously, to force the bougie under such circumstances is to court disaster. Cases of stricture requiring treatment are always severe cases, so that they require a very small bougie. Strictures are rarely concentric with a funnel shaped upper portion which might guide the bougie to the stricture. On the contrary, there are folds, bands, pockets, and diverticula that render the chances very much against a bougie finding the lumen of the strictured

passage. It is utterly unjustifiable under these circumstances to force a small bougie. There are many cases of death from this unsurgical, blind, rarely justifiable procedure. Anyone who has done, or seen done, the precise operation of passing an esophagoscope, locating the stricture, inserting an instrument therein, dilating the stricture and restoring the patient's power of swallowing will never endorse the reckless making of false passages in the mediastinum, pleura, pericardium, bronchi or lungs, by blind stabbing with a bougie.

If the stricture case gives a history of great difficulty in getting down soft solids, even though fluids pass without difficulty, it will be found, upon esophagoscopy, that the lumen of the stricture is exceedingly small and difficult to find. One wonders how even fluids could leak through in sufficient quantity to sustain life. In such cases the most brilliant results can be safely obtained with the aid of the esophagoscope.

The best form of bougie for these cases is Bunt's (Fig. 61). They are made with two olivary bulbs; one covering the point and one a size (French scale) larger, situated 3 cm. from the end. This has two advantages:

1. It permits following up a sized olive that passes readily and safely with one of a size that may safely do some dilating.

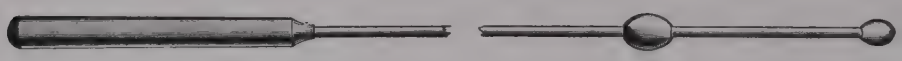


Fig. 61.—Bunt's double olive bougie.

2. The distance between the olives permits the passage of the intervening 3 cm. of stem before the second bulb engages in the stricture. This acts as a guide and assures safety in using some force on the second bulb.

Bunt used these bougies with the aid of the sense of touch, without the esophagoscope, and obtained excellent results. They are, however, more accurately and advantageously used with the aid of the esophagoscope.

The esophagoscope is passed, the esophageal wall closely inspected, scars, diverticula and other abnormalities examined. When the tube mouth reaches the constriction that is too narrow to admit it, if not too small, a smaller tube may be passed through the first, or, better, the first may be withdrawn and a smaller one introduced. In many cases it will be found that this first stricture is but the vestibule to a second, smaller stricture. There may be several strictures and in one instance, the author saw six. As a rule, they do not all require treatment other than to ensure their getting no smaller. Having arrived at a stricture which will not permit a 7 mm. esophagoscope to pass, the esophageal wall ahead is

sponged clean and a search is made for the lumen of the stricture. Very often this will be of almost a pin-hole size seen in the flat wall against which the tube mouth is gently pressed. Often prolonged exploration of a diverticulum or a number of diverticula will be necessary before the strictural opening is discovered. When found, the smallest Bunt bougie is inserted. If it pass readily, the next size is inserted, and so on up until a size is reached whose distal olive passes readily, but the second olive engages. This is pushed through and the next larger size is used. At the next treatment, three or four days later, these same sizes are used again, followed by one size larger. This is continued until a sufficiently large lumen is secured to permit the patient to swallow solids normally.

The ordinary flexible silk-and-wax bougie is then gently tried without the esophagoscope, the patient being instructed to make continual-swallowing efforts while the bougie is being passed. If the flexible bougie pass readily, the patient is taught to pass it himself, and instructed to pass it regularly once a week or oftener, if any signs of strictural closure supervene. After a time, once a month will be enough. This may be called a symptomatic cure and is brilliant compared to gastrostomy, either with or without retrograde dilatation.

Of the other methods, dilatation with a laminaria tent placed with the aid of the esophagoscope, deserves mention. It is carried on the end of a stylet fitted to the tube forceps (Fig. 22). The disadvantage to tent dilatations is that the tent expands more below the stricture than at it. This lower expansion in extraction has to be pulled through the stricture. This is not often difficult to do, but may be attended with slight risk, though no cases of untoward results have come to the author's knowledge. The axial tugging on the esophagus, rather than the stretching of the circumference constitutes the danger; for as demonstrated sphygmomanometrically by Boyce on some of the author's cases of laryngectomy, tugging on the esophagus produces a great fall in blood pressure.

Instrumental dilatation with steel expanding forceps is a feasible procedure and is advisable in a few instances. There is always some risk of rupture of the esophageal wall, which is a very serious complication. There are many other plans of treatment, instrumental, electrolytic, etc., but that given is the most practical.

Medicinal treatment is of no use so far as cure is concerned, but it may be well to know that cocain, adrenalin and morphin have a decided effect in temporarily opening a stricture sufficiently to permit liquids to pass. This is of use at times in tiding over a few days, when the patient is not seen until he is in a serious state of inanition. Under these circumstances it is also well to know that ice cream will go down when nothing else will. The action of the cold probably is to contract the chronically

inflamed mucosa, so as temporarily to increase the available lumen. Of course most of the ice cream is regurgitated, but enough leaks through to prevent starvation.

Malignant Disease of the Esophagus.

As in malignant disease elsewhere in the body, the crime of the day is in the failure to recognize malignancy and pre-malignant conditions early. It is not until emaciation, cachexia, regurgitation and absolute inability to swallow solids supervene that the profession, even the laryngological member of the profession, thinks of serious disease of the esophagus. All earlier stages are dismissed thoughtlessly with the label "globus hystericus." Illustrative of this the following case may be cited:

Miss L., aged 41, was under the author's care for chronic maxillary sinuitis. She mentioned incidentally that she felt a lump in her throat at times upon swallowing. When asked if she felt the lump rise in her throat when she was not attempting to swallow, she answered that at times she did. There had been no difficulty in getting even solid food down, and there was no regurgitation. She was undoubtly a neurasthenic, yet the author has made it a rule to consider that a neurasthenic may have a lesion as well as a person without neuropathy, and that a person with abnormal esophageal sensations should be examined as well as one with abnormal laryngeal sensations. In this instance, it was two months before the attending physician grudingly gave his consent to an esophageal examination. Under ether, preliminary to a secondary sinus operation, the esophagoscope was passed and an epithelioma (Fig. 8, Plate III.) discovered.

The foregoing case illustrates:

1. The latency of esophageal symptoms.

2. The necessity for the examination of the esophagus in all cases where any chronic throat symptoms, other than laryngeal, are complained of.

3. The fallacy of labelling (it would not be accurate to say diagnosticating) a case of "globus hystericus," because the patient complains of "a lump rising in the throat," whether she be a neurasthenic or a hysteric subject or not.

Malignant diseases of the esophagus for esophagoscopic purposes may be divided into endo-esophageal, muro-esophageal and peri-esophageal diseases. Naturally this only applies to the early stages. Late in the disease all three forms are usually combined.

Peri-esophageal disease in its earlier stages will present a hard resisting sensation to the end of the esophagoscope, though the overlying mucosa is normal. This is well shown in Fig. 7, Plate III, where the mass is to the left, the lumen to the right. This deviation of the lumen must be distinguished from the simple neglect of making the tube follow the direction

of the axis of the normal lumen. The figure is drawn from a case of epithelioma in a man 60 years of age, referred to me by Dr. Sanes. The esophagoscope could not be introduced past the hard mass, though the mucosa was normal. Later the wall and still later the mucosa, became involved.

The esophagoscopic appearances of muro-and endo-esophageal malignancy varies in different cases and in different stages. In the early stage Von Acker regards distinctive, slight narrowing of the lumen with islands of infiltration raising the mucosa in spots, the mucosa being reddish with purplish hemorrhagic dots, and with here and there enlarged vessels visible. This is an early condition prior to ulceration.

Gottstein, whose experience is large, describes five forms of esophagoscopic appearances in esophageal cancer.

1. Segmentary mural infiltration in thickened whitish patches alternating with bright red.

2. Annular form, seen as a more or less extended ring of infiltration which narrows the lumen below a fungating ulceration occupying more or less of the ring. Above this ulcerated area there is more or less dilatation dependent upon the duration of the narrowing. The mucosa of this dilated area is more or less altered.

3. Carcinomatous infiltration not only annular but funnel-shaped.

4. Bleeding cauliflower fungating masses.

5. Papillomatous vegetations.

The most common in form is the second.

Stoerk urges the diagnostic importance of the absence of the respiratory enlargement and the diminution of the esophageal lumen, due to infiltration of the esophageal walls. He also attaches weight to flat infiltration, bleeding after wiping, and superficial ulceration of the tumor.

It must not be forgotten that all of these appearances may be simulated by syphilis, but the therapeutic test will soon distinguish.

The taking of a specimen is in all cases advisable, and is quite harmless. If bleeding follow, which is rare, it can be stopped by swallowing ice cream, iced water, or pieces of ice. Epithelioma and endothelioma may be distinguished microscopically with some degree of certainty, if an adequate specimen be removed. But, obviously, the pathologist can only report on the specimen submitted, so that a good, ample specimen must be obtained, preferably one at the edge of the neoplasm and including both normal and neoplastic tissue. In cases of deep-seated growth covered with normal mucosa, it is useless to take a specimen unless the forceps be plunged deeply into the mass, which is seldom justifiable. In fibro-sarcomata, of which the author has seen one case, the microscopic appearances are characteristic, as they are also in sarcomata of other than the

small round-celled variety. The latter form is not with certainty distinguishable from tuberculoma, syphiloma, and inflammatory round-celled infiltration; at least such has been the author's experience from small inadequate specimens submitted to various pathologists. If the entire mass or a portion extending from the surface of the growth clear down into healthy tissue be obtained, the pathologist would have a fair opportunity and could give a dependable opinion in all cases.

The treatment of malignant disease of the upper portion of the esophagus when associated with similar disease in the larynx may be extirpated by resection of the esophagus at the laryngectomy. For extensive operative work upon the upper end of the esophagus, Mosher's ingenious speculum (Fig. 5) is well adapted. If the patient be not tracheotomized it is necessary to watch the breathing carefully while using this, as the broad flat surface is apt to close the laryngeal orifice. The author has had a large oval opening made in the spatular part of Mosher's instrument which obviates this to a great extent. It is better in most cases to do a tracheotomy as the chloroform may be administered through the tracheal canula by means of a simple piece of rubber tubing one end of which is fitted into the tracheal canula, while the other end has tied over its extremity a tuft of gauze upon which the chloroform is poured. Used with a tracheotomy, the Mosher instrument has the advantage of closing the laryngeal orifice so that tamponade of the larynx is unnecessary, or if tamponade be needed the instrument serves to hold the previously placed tampon in place.

In deeper portions of the esophagus palliative treatment will greatly prolong life and relieve pain. When stenosis threatens to interfere with nutrition the esophagoscope is introduced and the narrowed lumen dilated, as described in reference to cicatricial stricture. The ordinary flexible bougie should never be used except after the esophagoscope has determined the absence of ulceration or weakening of the esophageal wall.

Benign Neoplasms of the Esophagus.

Benign neoplasms, when large enough, produce esophageal stenosis. In many instances, however, they will be discovered quite accidentally. In this connection, however, it must be remembered that, at the present day, slight difficulty or inconvenience in swallowing is either absolutely ignored or labelled "neurasthenia" or "globus hystericus," and dismissed. Such a thing as examining the case with an esophagoscope does not seem to occur to the clinician's mind. When the neglected subject of esophageal disease receives its merited study, benign tumors will be found to be less infrequent than is at present supposed.

Edematous polypus has been observed but is rare. The most frequent benign tumors are, papillomata, fibromata, myomata, fibromyomata, mixomata, angiomata, lipomata, adenomata and cystomata.

The base of a benign growth is never indurated; though we must be on our guard against diagnostic error in case of its occurring at the site of a scar.

The naked eye diagnosis of benign tumors is only possible when they are observed to have long, distinct pedunculi. Malignant neoplasmata rarely, if ever, occur in this form. All sessile growths, whether ulcerated, fungating or smooth, can only be diagnosticated with certainty by the aid of the microscope. The removal of a specimen is always justifiable. No hemorrhage need be feared, if one condition be excluded, namely, varicosities of the esophageal vessels. Even in such a case it is doubtful if any hemorrhage will occur that will not yield to the eating of ice cream, or the swallowing of pieces of ice.

Treatment. All benign tumors of the esophagus demand removal. The possibility of their undergoing malignant degeneration is disputed, but, while it is true that cells never change their type, the benign neoplastic tissue is more liable than normal tissue to become the site of a malignant neoplasm.

For removal, strong forceps are necessary, especially in case of pedunculated tumors. Necessarily the pedunculi are tough and strongly attached, else the growth would be detached and swept downward by the swallowed food. It is necessary as a rule to bite out the mucosa where the peduncle is attached, not only because it is safer than the severe traction necessary to tear away the growth, but to prevent repullulation. This is illustrated in the following case:

Mr. P., aged 36 years, was referred to the author by Dr. Heard for vague and indefinite throat symptoms, which would certainly not have aroused any suspicion of esophageal disease in a mind not particularly bent toward the subject. He said his throat "bothered" him, he had some "throat trouble" and like indefinite expressions of his unlocated sensations. There was some cough, also occasional hoarseness. Examination with the laryngoscope revealed a chronic laryngitis, nothing more. Examination of the upper end of the esophagus with the laryngeal speculum revealed whitish granular tumor attached by a pedicle three centimeters in length. (Fig. 12, Plate III.) The pedicle was attached about two centimeters below the level of the interarytenoid space. Upon a subsequent examination with the laryngeal mirror the growth was seen lying in the interarytenoid space (Fig. 9, Plate III.). The growth was certainly not there at the first examination with the laryngeal mirror. The mystery was explained, however, when the patient was told to swallow, and upon re-examination the tumor was nowhere to be seen. The long pedicle permitted the tumor to rise above the introitus like a floating buoy above its anchorage, but in swallowing the growth was carried below the inferior constrictor. With the assistance of Dr. Heard, the neoplasm was removed under local anesthesia by direct inspection through the tubular speculum (Fig. 6). The peduncle was found of such a tough fibrous nature that the esophageal wall was pulled into the mouth of the speculum, without tearing away. The cup-shaped forceps

(Fig. 24) were then used to bite out the esophageal wall to which the peduncle was attached. The wound healed promptly and six months later there was no sign of recurrence. The growth was examined by Dr. Jonathan Wright, who pronounced it fibroma papillare.

This case is interesting as showing:

1. The absence of symptoms associated with small esophageal neoplasms.

2. The likelihood of overlooking such conditions.

3. The necessity of examination of the esophagus in all doubtful throat cases.

4. The ease with which the upper end of the esophagus can be examined, and the ease of removal of neoplasms therefrom, with the aid of the tubular speculum.

5. The advisability of excision of benign growths with the cupped forceps, as compared to evulsion with serrated forceps.

Many benign growths have a strong tendency to recur. They do not infiltrate, hence are not malignant, but they repullulate in a most stubborn manner if any portion is left.

Spastic Stenoses of the Esophagus.

Cardiospasm, as its name implies, is applied to a condition of spasmodic closure of the cardiac orifice of the stomach. It is applied, however, to spasmodic closure of the esophageal lumen without limitation strictly to the cardia. The cardia is not a genuine sphincter, though Hyrtl has demonstrated circular fibres. The prevention of regurgitation is probably as much a kinking of the esophagus due to expansion and upward movement of the fundus ventriculi as to any sphincter-like action at the cardiac orifice. There is, however, a distinct sphincter-like action at the hiatus esophageus. Wherever future study may demonstrate the seat of the spasm to be, there can be no doubt of its occurrence. Many observers have seen it. In all three of the author's cases it occurred in the abdominal esophagus between the cardia (as indicated by the mucosa) and the hiatus. In two of these cases it was associated with peptic ulcer of the abdominal esophagus. It disappeared completely while the patient was under deep general anesthesia. It was associated with slight dilatation of the superjacent esophagus. A number of competent observers have noted this dilatation of a very marked degree.

Phrenospasm is a name given by the author to a closure of the esophagus at the hiatus esophageus by a tonic spasm of the neighboring portion of the diaphragm. It is frequently seen in passing the long esophagoscope or gastroscope without anesthesia or in withdrawal of the instrument after the tube mouth has retreated from the hiatal portion of the esophagus. Frequently in the absence of anesthesia, the instrument is clamped so

tightly in this phrenospasm that the movements of the tube are hindered. It disappears completely during the relaxation of deep general anesthesia. This complete disappearance of the obstruction, along with a normal yielding wall and a normal mucosa establishes the diagnosis absolutely. It is almost invariably associated with dilatation of the portion of the eophagus immediately above it, just as organic stricture is.

Esophagospasm or esophagismus is usually the condition found in globus hystericus. It is associated with great difficulty in introducing an esophagoscope under local anesthesia, but it disappears promptly under deep anesthesia, when the esophagoscope may be passed freely up and down the esophagus, revealing a wall of normal resiliency, which wall shows the normal respiratory excursion, and which is covered with normal mucosa. Occasionally esophagismus will be found to be secondary to a lesion, the most frequent lesion being a simple ulcer.

The treatment of spastic conditions of the esophagus may be palliative or curative. Palliative treatment consists in the use of iced liquid food in some instances, of hot liquids in others. Drugs as morphin and cocain have an effect, but their use should be avoided. Curative treatment consists in the cure of ulcers if present, in the application of galvanism with the olive-pointed electrode, and in bouginage. After the esophagoscope has demonstrated the normality of the esophageal wall, the daily passage of the flexible esophageal bougie by the patient will establish a cure after extreme tolerance to the bougie is developed. Retrograde instrumental dilatation is used in extreme cases, but the esophagoscopic dilatation is the most useful in abolishing the hypersensibility of the esophagus, which is the chief factor in many cases.

Compression Stenoses of the Esophagus.

Compression stenoses of the esophagus are produced by many different conditions. Hypertrophic, inflammatory, neoplastic and exudative diseases of adjacent tissues may compress the esophagus. The most frequent conditions are: struma, glandular infiltrations, mediastinal or cervical tumors, aneurysms, pleural and pericardial effusions, abscesses, spinal deformities, etcetera.

The differential diagnosis of these conditions depends less upon endoscopic examination than upon general clinical diagnostic methods. The location of the stenosis as measured esophagoscopically is often an aid. In aneurysm the pulsations are diagnostic, if the observer is familiar with the normal pulsatory movements as observed in the esophagoscope. The radiograph is a very important aid in diagnosticating aneurysm and some forms of mediastinal tumors. (Figs. 50 and 62.) In aneurysm the pulsations may be seen fluoroscopically.

FIG. 62.—Radiogram showing location of a malignant mediastinal tumor producing compression stenosis of the esophagus.

CHAPTER XV.

Non-Stenotic Diseases of the Esophagus.

Diverticula.

A diverticulum is a circumscribed ectasia of the esophageal wall, in contra-distinction to a dilatation which is a diffuse ectasia. Though a diverticulum of the esophagus is not in itself a stenotic disease, it is usually associated with a subjacent stenosis, which is the chief factor in its production. This form is called a pressure diverticulum, because of the probable etiologic influence of the pressure of the esophageal contents, which the musculature is endeavoring to propel. The other form is called a traction diverticulum, being due to traction, as by an adhesion, externally on a circumscribed portion of the esophageal wall.

The esophagoscopic picture is not as clear as might be at first supposed, though the diagnosis can be made in every case by careful exploration. The possibility of the presence of a diverticulum must be borne in mind in every case of esophagoscopy. When the esophagoscope enters the diverticulum the orifice of the sub-diverticular esophagus is usually not noticed. The tube mouth comes against a flat surface which is usually mistaken for a strictural or neoplastic stenosis. The tube is withdrawn and yet no orifice is seen. Often it cannot be found until regurgitation forces some fluid through, or forms one or more bubbles. The orifice is usually very small, often slit like, and hidden by a fold or band. To favor regurgitation, the patient, if under general anesthesia, should be allowed to come out partially. The bottom of the diverticulum is usually chronically inflamed as shown in Fig. 5, Plate III, drawn from one of the author's cases. This chronic inflammation is probably due to the presence of food, which is not well tolerated by the esophagus. The normal esophagus endeavors to rid itself of everything, even its own secretions, by upward or downward expulsion. Frequently the diverticulum will be found full of secretions, but, with the aspirator attached to the esophagoscope, (Figs. 17 and 18,) the latter is slowly inserted and the secretions

removed ahead of the tube in a manner that eliminates all trouble from this source during the examination. Large masses of food, sometimes present, may be removed with the forceps.

The treatment of diverticula is mainly surgical. Dilatation of the sub-diverticular stricture will produce a symptomatic cure and occasionally some recession of the size of the diverticulum may thus be brought about, if the strictured passage be kept open. If so located that external surgery is of aid, a radical cure may be brought about. Such cases have been reported by Depage, Kocher, Bilroth, Goris, and others.

Dilatation of the Esophagus.

Dilatation is a diffuse ectasia of the esophageal wall, in contra-distinction to a diverticulum which is a circumscribed ectasia.

The most common form is the spindle shaped esophagus.

It is very rare in the upper portion of the esophagus. It occurs in three classes of cases:

1. Those in which there is below the dilatation an anatomic stricture which is evidently its cause.

2. Those in which there is a spasmodic stricture, usually a phrenospasm or cardiospasm below the dilatation.

3. Those in which there is no stricture anatomic or spastic demonstrable, and which are supposed to be due to atony of the esophageal wall. There is every likelihood that there has existed at some previous time a cardiospasm or a phrenospasm.

Various clinical and chemical methods of differential diagnosis between diffuse dilatation and diverticulum have been advocated from time to time, but none of them compare in accuracy with the simple procedure of esophagoscopy, by which we put a tube down and actually see the conditions present.

The esophagoscopic picture in dilatation is unmistakable. In the normal esophagus, the walls are visible at all times; the lumen enlarging upon inspiration, but never to such an extent that the walls are not visible. In dilatation, on the contrary, during inspiration the entire wall disappears and the tube end is seen to be in a large cavity, the walls of which are ballooned out. The upper wall, if the patient be in dorsal decubitus, may sag downward, and it will be noticed that to bring the lower (posterior) wall into view the tube mouth must be lowered quite a distance. Laterally the enlargement of the lumen is equally apparent upon a lateral movement of the tube mouth. Of course, this description applies to extreme degrees of dilatation. All sizes and stages of dilatations are met with and the lesser degrees may raise the question of the border line between normality and disease.

The dilatation is not always concentric and it is not always possible to determine whether it is concentric or not. The possible extent of lateral drag in all directions is some criterion, but this varies within the limits of health, and considerable experience in esophagoscopy is necessary to determine the degree of eccentricity of the dilatation, and, indeed, the presence of a dilatation, if the dilatation be of very slight degree.

Dilatations, if of any size, usually contain food particles, and also more secretion than the normal esophagus, due to the chronic turgescence and inflammation of the mucosa. The accumulation is due rather to the obstruction below, and to the motor insufficiency than to the mere dilatation per se. The mucosa often shows dilated capillaries and occasionally erosions. In cases associated with cicatricial stenosis, cicatrices may be seen. In pushing the tube on downward the presence of the subjacent stenosis and its character, whether anatomic, cardiospastic, or phrenospastic will be determined as before described when speaking of stenotic diseases.

A tumor more frequently malignant than benign may exist in the dilatation. Ulceration, benign or malignant, occurs. In cardiospastic and phrenospastic dilatations, the mucosa is very much reddened, especially in the upper two-thirds of the dilatation. In the lower third, it is usually paler and the dilated branching capillaries are particularly noticeable at the site of the spastic stricture. Below this the mucosa is sometimes noticed to fold in over the end of the tube in transverse folds.

The differential diagnosis between spasmogenic dilatations and those resulting from anatomic stricture is easily made by the determination of the presence or absence of an anatomic stenosis. The differential diagnosis between spasmogenic and atonic dilatations, if, indeed the latter kind ever exists alone, is difficult. As previously stated, the author's belief is that the so-called atonic dilatation is a result of pre-existant spasmogenic conditions. The differential diagnosis between dilatation and a deeply situated diverticulum, impossible by other methods, is easily made esophagoscopically. If a diverticulum exists, no hiatal slit or cardia will be found, instead, the tube mouth will stop against a lightly stretched wall, the bottom of the diverticulum. The orifice of the subdiverticular esophagus can be found by careful search as the esophagoscope is very slowly withdrawn.

The treatment of dilatations is based upon eradication of the cause. The subjacent stenosis, anatomic or spastic must be dealt with. If anatomic it is treated as previously outlined, by dilatation, forcible or preferably gradual. The wearing of a short tube or sound for an hour or more is beneficial, but the size must be exactly determined so as to cause some dilatation and yet not too much. The size should be gradually increased,

and a strong heavy braided silk cord must be attached for removal. Electrolytic dilatation of the stricture might be tried. The inflammation and ulceration of the mucosa can be treated by topical applications, if necessary, after the relief of the dilatogenic stenosis. Often it will not be necessary.

Inflammation and Ulceration of the Esophagus.

Acute esophagitis arising from any cause save traumatism is a positive contra-indication to esophagoscopy. Where due to traumatism, esophagoscopy is also contraindicated save where the traumatic agent, as a foreign body, is still in the esophagus. In this case it should be removed at once.

The esophagoscopic appearances are those of an acute mucosal inflammation elsewhere. Intense congestion of the mucosal capillaries produces as intense reddening, which may be diffuse or circumscribed according to origin. If the inflammation is more intense in some point than others, a flecked or patchy appearance may be observed. After the incipient stage is passed, if serous effusion takes place, the mucosa assumes the edematous semitranslucent appearance often seen in the larynx. Vessels are not, as a rule, visible in acute inflammation.

Acute inflammation is easily diagnosticated, but care must be taken that we do not overlook associated lesions. For instance, a mural esophageal carcinoma may be intruding the overlying mucosa into the lumen, wherewith the irritation thus resulting, the mucosa may give the appearance of acute inflammation.

Chronic esophagitis may follow acute esophagitis, or, more frequently, it may be the result of long-continued irritation of food particles, mucus, pus, etcetera, which are entrapped in the esophagus by spastic or anatomic stenoses, dilatations or diverticula, which prevent the esophagus from immediately emptying itself, which it always does promptly under normal conditions.

Uncomplicated simple catarrhal inflammation of the esophagus exists, commonly in alcoholics, due to general engorgement and vasomotor relaxation from the systemic action of the alcohol, and also from the local irritant effect of the insufficiently diluted alcohol upon the esophageal mucosa. Catarrhal inflammations also result from other causes local and systemic, the latter usually diathetic.

The esophagoscopic appearances are usually a dirty gray, or grayish white, or pale red, sometimes mottled, mucosa streaked with vessels, and covered with a tenacious mucus which is sponged away with difficulty. (Fig. 5, Plate III.)

Ulceration is often seen. Ulcers may be divided into two general classes:

Those above and those below the hiatus. The upper class may be due to the same causes as the inflammation, abrasions and the like, or they may be due to the intensity of the inflammation itself, resulting in a localized tissue necrosis. They may be due to a local thrombosis of embolic or other origin. Those occurring in typhoid fever are usually of thrombotic pathology. Epithelial erosions frequently occur in profound toxemic states in the course of the general infections.

Deep ulcerations occur in syphilis more often than is realized, as unless the resultant cicatrix is sufficient to interfere seriously with deglutition the lesion is overlooked, as it is usually painless. Deep ulcerative lesions occur in tuberculosis, and is very frequently overlooked. As much as four-fifths of the esophagus has been known to be involved without an esophageal disease having been suspected. The author has seen a great many cases where the dysphagia and odynphagia present were attributed to the concomitant laryngeal tubercular lesion. Tuberculosis of the esophagus, like that of the larynx, is usually secondary to a pulmonary lesion, the infection being conveyed by the sputum; or it may occur by continuative extension from a tubercular bronchial gland or vertebra. It may occur by contiguous extension, as for instance on the posterior wall from contact of the tubercular larynx. (Fig. 6, Plate III.)

Peptic ulcer. Ulcers occurring below the hiatus esophageus are usually classed as peptic ulcers and often bear a strong resemblance to peptic ulcer of the stomach. They are often attributed to functional insufficiency of the cardia, but the author's opinion elsewhere stated is that the functional closure of the upper end of the stomach is due to a kinking of the esophagus at the hiatus, due to pressure of the gastric fundus and the peri-hiatal structures. This permits the stomachal contents frequently to invade the lower end of the esophagus. Whatever may be the pathology of peptic ulceration of the esophagus, it has a pathology essentially different from that of other mucosal ulcerations. In whatever they may consist these differences are participated in to some extent by duodenal and lower esphageal ulcerations. It is, therefore, logical to suppose that the stomach contents are a factor in the production of these ulcerations.

Ulcerations of pathology other than that of those enumerated occur rarely. When an unexplainable ulcer is found, especially if fungating a buried foreign body should be thought of.

The treatment of inflammation and ulceration, consists in removal of the cause, be it local or general. Then topical applications of argentic nitrate, argyrol, glycerole of iodin or of tannin will be beneficial. If

the lesion be circumscribed, the applications should be made with a dossil of cotton on a sponge holder. In the treatment of peptic ulcer the general methods advocated for gastric ulcer are useful, but they are of only secondary importance to the direct application of silver nitrate, argyrol, etcetera, to the ulcer under direct inspection of the eye, looking through the esophagoscope. Bismuth powder may be blown directly upon the ulcer by means of the extra drainage tube. The ulcerated surface should first be cleaned off with a dossil of cotton dipped in hydrogen peroxid solution. There is no danger of either perforation or of hemorrhage from these procedures if the manipulations be gentle, and guided by the eye through the esophagoscope. There is great danger from blind poking with a bougie, especially in these lowly situated ulcers, as reflex spasm from the presence of the tube is apt to close up the lumen ahead.

Neuroses of the Esophagus.

Spastic neuroses have already been touched upon.

Sensory neuroses, including hyperesthesia, anesthesia, and paraesthesia exist, but careful esophagoscopic search often reveals an anatomic basis, such as an ulcer, a scar, or an inflammatory area, in cases in which theretofore a diagnosis of neurosis had been made on the anamnesis and sounding. The symptoms complained of are usually of a vague character as of contraction, itching, sticking, pricking, uneasiness or irritation, or of a foreign body or crawling insect.

Exclusive of hysteria, sensory neurosis of the esophagus will be found exceedingly rare. In almost all cases of anamnestic similarity will be found to be anatomic, not purely neurotic in origin.

The treatment is by very mild galvanism locally, using the interrupted current, and general treatment and regime as deemed best by the internist or neurologist.

Paralysis and Pareses of the Esophagus.

The symptoms of defective inervation of the esophagus point very markedly to esophageal trouble. All solid food is swallowed with difficulty; fluids are usually swallowed freely. In some cases even fluids refuse to go down except in very small quantities. There are pain back of the sternum after eating, regurgitation of food and mucus.

With a history of trouble of this magnitude one is apt to expect the esophagoscope to meet with obstruction to its passage. Exactly the reverse is the case. It readily enters the introitus and passes on down into the stomach without the slightest resistance, going as readily without an anesthetic as it would in the normal esophagus with the deepest general

anesthesia. Thus the diagnosis is established. In spastic stenoses we find the spasm if no anesthetic be used, while in anatomic stenoses we find a stricture uninfluenced by anesthesia. The paralysis may be ocularly demonstrated by Stark's pill experiment. With the aid of an esophagoscope and forceps a pill or capsule is deposited in the esophagus at a distance of 27 cm. from the upper teeth. If the peristalsis be normal the pill will be carried downward into the stomach; if the pill remains where placed it demonstrates a paralysis or at least an abnormal feebleness or atony of the esophageal musculature.

The causes of paralytic conditions of the esophagus include central and peripheral nerve lesions, most common being bulbar paralysis and neuritis, including diptheritic, alcoholic and lead palsies.

The treatment of these conditions is usually not esophagoscopic, but general. Local electrical applications are beneficial adjuncts.

It must be confessed that we know but little of esophageal neuroses and much remains to be studied esophagoscopically. For this purpose all clinical material should be availed of, and experimentally the dog may be used, double vagotomy, being done under chloretone and morphin anesthesia.

CHAPTER XVI.

Foreign Bodies in the Esophagus.

Considering the brilliant achievements of esophagoscopy in the removal of foreign bodies from the esophagus, it is time to pronounce the prevalent use of the sound, the vertebrated forceps, the coin catcher, the bristle and the sponge probangs obsolete, dangerous, unsurgical and utterly unjustifiable. There are numerous cases on record of fatal results from their use, and there are many times as many cases that have never been reported. The author has seen in consultation two fatal cases from attempted extraction, both unsuccessful. In one case a sound (with stilet) had been pushed through the thoracic esophageal wall in an effort to push a peach stone downward, and in the other, the esophagus had been ripped open by a coin catcher. A number of instances of shock from esophageal wounds have been observed by the author, and many cases of minor wounds. (Fig. 10, Plate III.) Even the sound may make dangerous wounds by forcing a sharp or pointed body through the esophageal wall. Equally erroneous and dangerous is the practice of making light of the patient's fears, and the telling him that if he has swallowed anything, it will go on downward without doing any harm. Some things will, and others will not. Pointed and sharp objects, as a rule, lodge, perforate and often prove fatal. Smooth round objects, such as intubation tubes, usually pass without difficulty. Coins are very prone to lodge, though usually in a vertical position, so that they allow food to pass. In one case of the author's a penny remained in the esophagus of an 18-months-old child for two months and eroded through into the trachea.

The anamnesis is unreliable and misleading. The patient often does not know that he has a foreign body, but comes for difficulty in swallowing. In infants the swallowing of the foreign body may not have been observed. The little patient is taken to the physician for regurgitation of food, or as in one case of the author's for respiratory difficulty, which arose from perforation of the foreign body from the esophagus forward into the trachea. Often patients will say they no longer feel it when the

foreign body is still in situ. Still more misleading is the patient's localization. The corpus delicti is very rarely located where the patient assures us it is.

The Roentgen ray is much more reliable and its aid should be availed of in every case. What has been said in a previous chapter in regard to the ray in the diagnosis of foreign bodies in the air passages, applies equally well in relation to the esophagus. It may be well here to emphasize a statement there made. In no case should a negative radiograph deter one from making an esophagoscopic examination, if the anamnesis or the symptoms justify a suspicion of the presence of a foreign substance.

In a number of instances the author has been rewarded by success in the face of a negative radiograph. In other instances he has found lesions of the esophagus due to long standing disease attributed to a supposed swallowing of a foreign body. In one instance the patient complained of the lodgement of a chicken bone which she located back of the sternum, where she could feel it every time she swallowed. Upon gastroscopic examination an old ulcer was found just above the cardia, and another on the posterior wall of the stomach. As suggested by Dr. Clement Jones, who assisted at the gastroscopy, a large bolus of food in passing the ulcer had produced a sensation of pain which had since persisted, and which had been wrongly attributed to a supposed bone.

The matter of anesthesia is governed by rules elsewhere given. Local anesthesia is sufficient, though as a rule, a general anesthetic is better in all cases free from respiratory difficulty, which complication is more frequent than might at first be supposed. In addition to edema of the larynx from previous blind groping attempts at removal, there may be mechanical obstruction of the trachea from pressure of a large body or from inflammatory exudates in the tracheo-esophageal wall, or possibly feebleness of the respiratory movements from pressure of the foreign substance or inflammatory exudates upon the vagi.

When a case suspected of a foreign body comes to the author, a regular routine is followed. After taking the history, the nasopharynx, fauces, pillars, tonsils, the back of the tongue, gloss-epiglottic fossæ, larynx, and all parts of the upper air passages accessible are examined with the mirror and brushed with a cotton mop. If nothing is found the case is sent to a Roentgenologist and a plate is made (the fluoroscope is not used). If no foreign substance is seen and the symptoms and anamnesis warrant the case is esophagoscopized; and, if nothing is found, the trachea and larger bronchi are examined in some cases, if the foreign body supposed to be present is small enough to pass the glottis. If the radiograph shows the foreign body to be in the thoracic

esophagus, there is a great temptation to put the esophagoscope down at once to the point located. This would be a mistake. The tubular speculum should first be used to examine the pyriform sinuses and all the neighborhood of the introitus. The necessity of this is shown by a case referred to the author by Dr. Pool. While we were esophagoscopically searching the thoracic esophagus at the level of the fourth dorsal vertebra, where the pin was when the radiograph was made by Dr. Boggs, the assistant picked the pin out of the mouth with the fingers. Possibly it had been regurgitated by the retching incidental to the application of the local anesthetic. Be this as it may, it emphasizes the rule to examine seriatim all the surfaces from above downward. This pin might have escaped into the air passages. Another reason for the rule is that lesions weakening the walls or exposing vessels may exist coincidentally or as a cause of the symptoms of a foreign body when none exists. The only safe and certain way is by careful, orderly procedure to examine all tissues.

The technic of the passing of the esophagoscope is given under "Gastroscopy." As a rule, the finding of a foreign body in the esophagus is a very easy matter. It is possible, however, for it to get so buried in the swollen mucosa as not to be visible. In one case referred to the author by Dr. Day a double-pointed pin (D Fig. 63) was buried out of sight, having penetrated beneath the mucosa and having wandered from the point of entrance. Even in such a case patient search is usually successful. The same may be said of foreign bodies lodged in diverticula. When found, the foreign substance may be so large that it cannot be extracted through the esophagoscope. In such a case the tube, forceps and the intruder are all withdrawn together. The foreign body may be so sharp or so angular or pointed that to remove it involves serious risk of wounding the esophageal wall. If the points cannot be covered by withdrawal into the esophagoscope, the substance in some instances may be divided and removed in sections.

In the case of an open safety pin with point downward, a hook or forceps may be used to draw it into the esophagoscope. If the point is upward (Fig. 64), it may be possible to draw the point into the tube mouth with the forceps, to turn the pin with a hook inserted in the ring of the spring end. This, however, involves some risk of forcing the point through the esophageal wall. A safer plan is to close the pin. The credit of having first done this belongs to Mosher. The ring of the instrument (Fig. 27) is inserted and insinuated into position below the pin which is then pushed into the ring with the pronged instrument.

The author has modified this instrument to facilitate its introduction. The ring lies in the same plane as the stem during introduction, and is

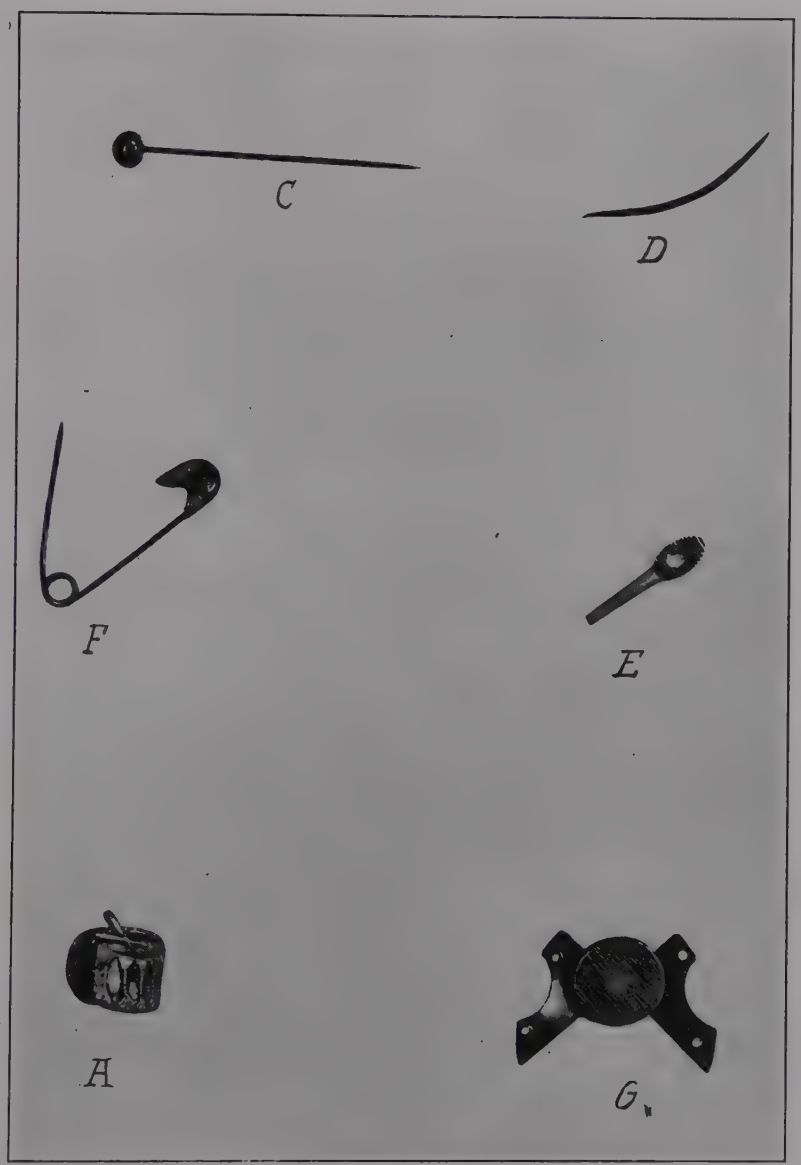


FIG. 63.—Foreign bodies removed by esophagoscopy and gastroscopy.
(From the author's collection.)

C, Pin removed from esophagus of pregnant woman aged 23 years. Cocain.
F, Safety pin from esophagus of 9 months' old infant. Chloroform.
E, Forceps jaw removed from the stomach of man aged 32 years. Ether.
A, Cuff button removed from esophagus of 4 months' old infant. Cocain.
G, Joint of carpenter's rule removed from esophagus of boy of 7 years. Cocain.

turned to a right angle after it has reached a point below the pin. If the ring of the needed size for the particular pin is too large for introduction through the esophagoscope, the closer may be started in first, and the esophagoscope "threaded" over it, or the esophagoscope may be started alongside the stem of the closer. In the latter case care must be taken that the combined diameters of the closer and the esophagoscope do not exceed the safe dilatability of the esophageal lumen.

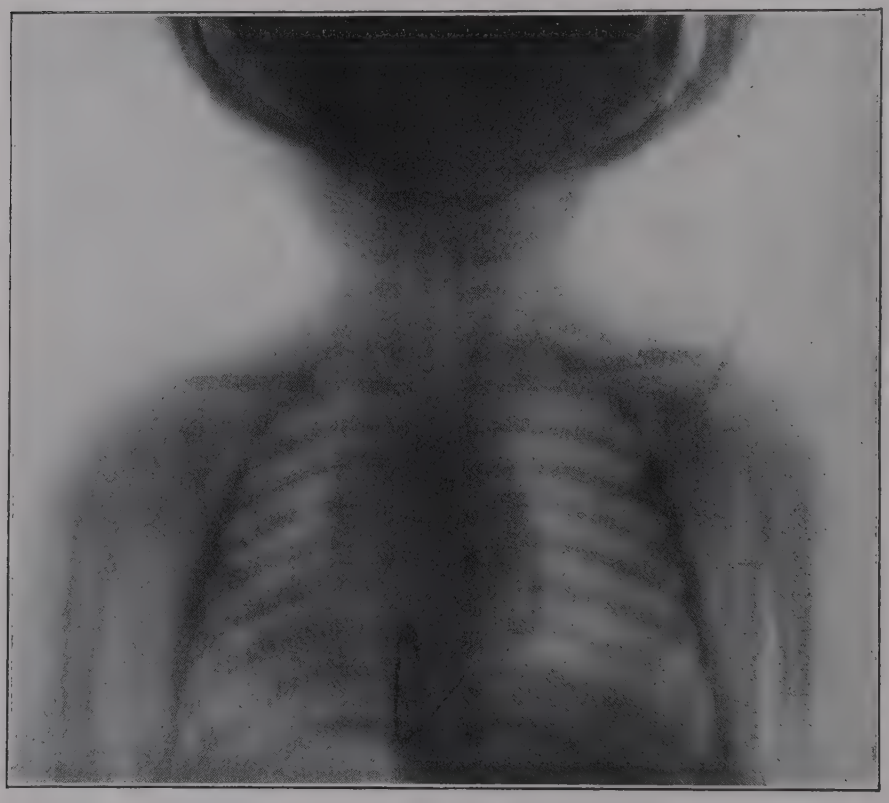


FIG. 64.—Open safety pin in esophagus.

Part III.
GASTROSCOPY.

CHAPTER XVII.

History of Gastroscopy.

When the author first obtained good endoscopic views of the stomach he thought it had never been attempted before. But a search of the literature brought to light several previous attempts.

Nitze and Leiter. The first recorded attempt to construct a gastroscope was by Mr. Leiter and Dr. Nitze, whose names are inseparably connected with the cystoscope. Both before and after this time attempts to construct flexible and jointed instruments containing optical apparatus failed in the mechanical stage.

Trouve, in 1873, perfected a "polyscope" (Fig. 65) with which Collin, of France, demonstrated endoscopically the functions of the stomach

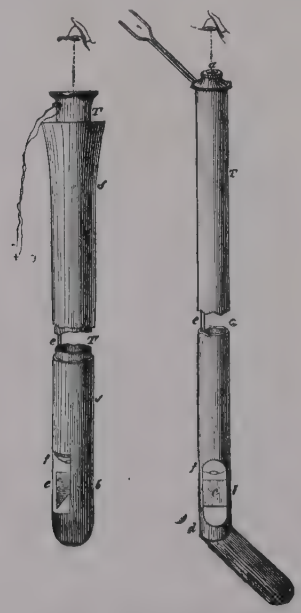


FIG. 65.—The "Polyscope" of Trouve.

of a bull, and with which Ledentu and Raynaud diagnosticated a cicatricial stricture of the esophagus near the cardia.

Mikulicz, in 1881, started on the basis that a gastroscope must be rigid, but after repeated trials he came to the conclusion that a straight rigid instrument could not be passed into the stomach on account of the physiologic curve of the vertebral column, to accommodate his instrument to which, he gave the instrument an angle of 150° at the junction of the ventral and middle thirds. (Fig. 66, F.) This angle prevented a rotation

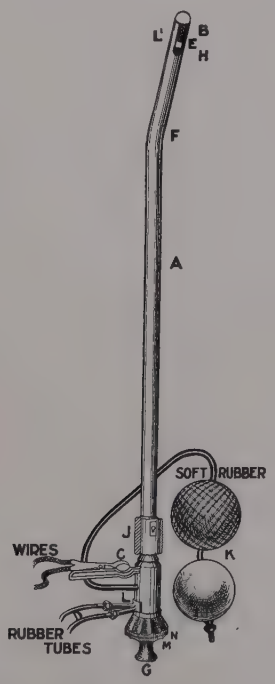


FIG. 66—Mikulicz's gastroscope.

of more than 180° within the stomach, so that two complete instruments were necessary with windows opening in opposite directions as shown in Fig. 67. To touch the gastric walls means to fog the window and dim the image. The Mikulicz gastroscope was 65 cm. long and 14 mm. thick. The light was furnished by a platinum loop at the ventral end which shone through a window in the side (Fig. 66, B). The loop was supplied with current by wires entering at C, and was kept cool by water circulating through two canals in the wall of the tube, the entrance and exit being shown at D. A third canal in the wall of the tube, with an exit at L^1 was for inflation of the stomach with air pumped in at L. One did not look directly at the tissues, but an image was projected outward through a ter-

restrial telescopic optic apparatus with the aid of two prisms, one at E and one at F. To prevent soiling the window during introduction, a slide is attached at H, operated by a hand-piece J, by which the window is uncovered after the stomach walls are distended.

Mikulicz arrived at the conclusion that a straight instrument was absolutely impracticable; that it could be passed as far as the cardia, which he believed to be located at the eighth or ninth vertebra, where it encountered an insurpassable obstruction in the subjacent vertebra. His straight experimental staff never really reached the cardia at all. What he encountered was the constriction, anatomic and spasmodic, at the hiatus diaphragmatis and the subjacent esophageal curve. Later Mikulicz tried to adapt to gastroscopy his method of passing the esophagoscope, by which, instead of a mandrin he introduced a flexible bougie, the distal

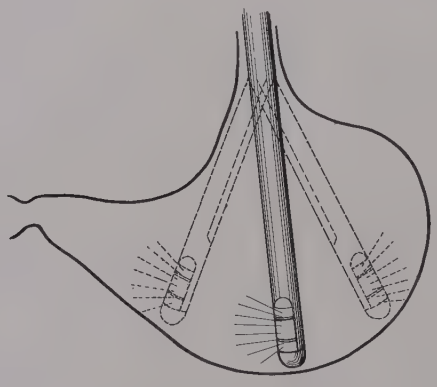


FIG. 67.—Mikulicz's gastroscope in stomach. Dotted lines show the necessity for right and left instruments. Center instrument does not show its bend.

end of which protruding 10 cm. beyond the esophagoscope, piloted the latter in. He did not succeed in thus piloting the gastroscope.

Mikulicz used morphin anesthesia and placed the patient on a table in lateral horizontal position, first one side then the other, according as the right or left gastroscope was being used. In quite a proportion of cases Mikulicz was unable to pass his gastroscope into the stomach. He tried chloroform, but states that under partial anesthesia the reflex irritability seemed to be so much increased that he could not get his instrument even into the esophagus; while under deep anesthesia he was afraid to pass it lest it might prove dangerous from pressure on the trachea, larynx or other parts. Mikulicz's examinations were mostly on healthy persons, as he thought the normal was to be studied first, and he seemed to doubt the safety of examining the stomach in serious disease of this organ. With one exception he did not record the appearance of any

lesion within the stomach, and his description of the normal is very meagre and unillustrated.

After 1883 no account of the use of gastroscopy appears in literature for 12 years, and the procedure was evidently abandoned by its originator.

Rosenheim, in 1896, reported experiments with a gastroscope 12 mm.

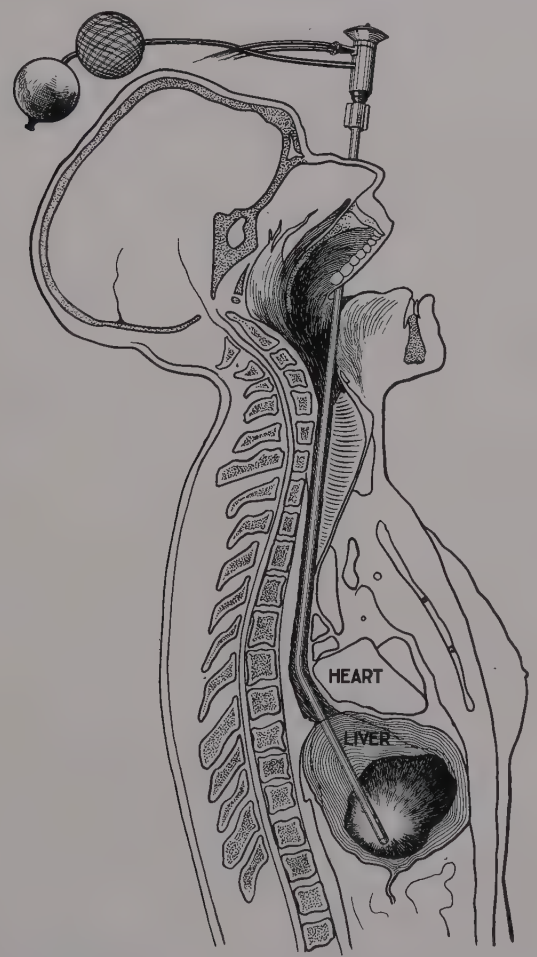


FIG. 68.—Mikulicz's gastroscope in situ. Drawing by Mikulicz to show impossibility of passing a straight instrument.

in diameter, 68 cm. in length. It was made up of three concentric tubes, the inner (1, Fig. 69) being a terrestrial telescope of 60°, with the addition of a prism below the objective, a different prism to be substituted to inspect different areas as shown in Fig. 70, the optic tube being withdrawn for the purpose. External to the optic tube is the intermediate or illuminat-

ing tube, containing a window, F, behind which is the electric lamp, S. Above this window is an opening closed by the prism of the optic tube. Four canals run in the walls of this intermediate tube (*2*, Fig. 69); two for water (C.D.) circulation to cool the lamp, (water at 40° C to prevent condensation on the glass surfaces being required); a third canal for con-

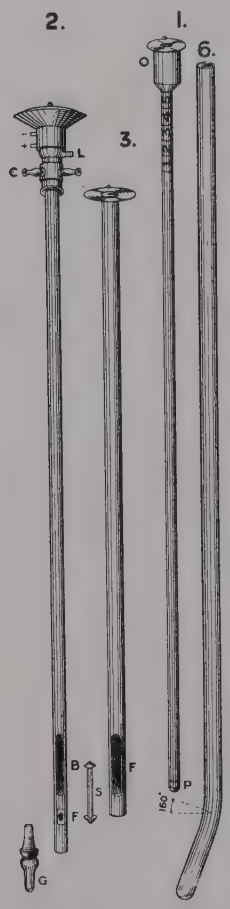


FIG. 69.—Rosenheim's gastroscope.
1, Optical apparatus. 2, Cooling water jacket. 3, Casing to keep window clean during introduction. S, Lamp. G, Rubber tip. 6, Rigid exploratory staff, hard rubber.

ducting wires; and a fourth canal beginning at L and ending below F, for the purpose of inflating the stomach with air. The external tube (3) serves two purposes; a measure of depth by its scale markings, and a protector to prevent soiling of the window and the prism during introduction, the external tube being turned after introduction so that its windows

may correspond to those of the optic and intermediate tubes, all three being known to be in line when the knobs on the external flanges of all three are in line. The stativ (Fig. 71) holds the supply and escape vessels for circulating water and the battery. Rosenheim tried to dispense with the water circulation, but the great heat of the platinum filament lamp confined in a closed instrument threatened cauterization of the mucosa if lighted for longer than ten seconds.

In addition to the straight gastroscope, Rosenheim states that in some cases the spiral twist of the lower esophagus required an instrument bent at an angle of 160° at a point 7 cm. from its distal extremity (6, Fig. 69). He also used a straight rigid staff of the size of the gastroscope to ascertain if it were possible to pass his gastroscope in the particular case, and if possible to measure the distance that the gastroscope will have to be introduced. He also used a straight sound to overcome the reflex excitability in difficult cases. This straight sound could be introduced in only

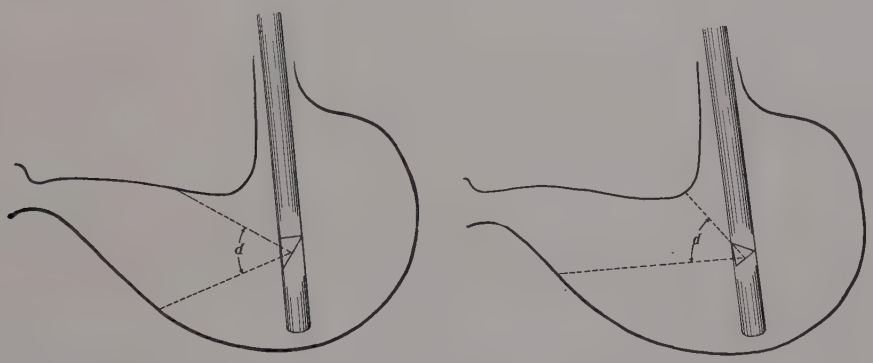


FIG 70.—Rosenheim's gastroscope in stomach, showing need for prisms of different degrees.

about 70 per cent of his cases. He found that various bends and curves were necessary and in some instances he used a corkscrew-like twist, throwing the longitudinal axes of parts of the instrument above and below the bend out of the same plane. A very significant fact is that after the beak of the instrument entered the stomach the straight part followed readily. His whole trouble in introduction was that his instrument was not designed to be passed by sight. He used cocain anesthesia applied with an esophageal syringe.

As to results, Rosenheim states that gastroscopy is impossible in tumor of the stomach, and that it is contra-indicated in ulcer.

Rewidzof, in 1889, reported results with a modified Rosenheim gastroscope which he passed through a previously introduced flexible rubber tube.

None of these early workers has left us any drawing of what he saw, and the written descriptions are hopelessly meagre. The procedure has been entirely abandoned. The cause for the failure and abandonment of gastroscopy may be summed up in two words; Impractical instruments.

At the door of the Nitze cystoscope must be laid the blame of the practical failure of gastroscopy up until the present day. The attempt to adapt the cystoscopic principles to the totally different conditions in the

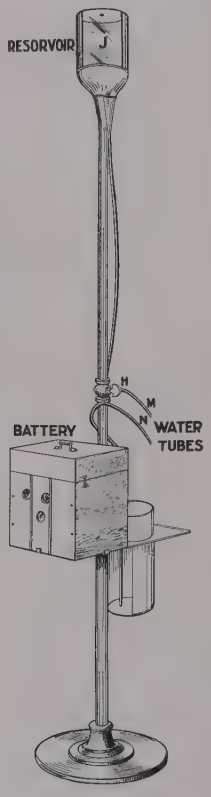


FIG. 71.—Stativ for Rosenheim's gastroscope.

stomach resulted in the misdirection of the earnest, able, scientific efforts of Mikulicz, Rosenheim and Rewidzof.

The instruments were difficult of introduction. The optic apparatus absorbed light and yielded a feeble image, which soon disappeared altogether from soiling of the window every time it touched the mucosa. For the same reason the apparatus could not be greased for introduction.

The optic apparatus, furthermore, prevented the passage of the instruments by sight, it prevented the wiping away of secretions and the

probing of suspected areas, without which little or nothing can be learned. The stomach had to be empty, which it never is. All failed to recognize the mistake of trying to see a large field in a dilated stomach. The field must be traversed in the collapsed state of the stomach, fold by fold. These things are not said in criticism, for, while the work of these pioneers was of no help to the author, as his work was done before he learned of their labors, yet they have rendered great aid, as we now know by their lack of success, that cystoscopic methods are not adapted to gastroscopic work. This would certainly have been tried by others, and much time and thought consumed by some one. Mikulicz himself recognized the complexity of his apparatus. He said: "There remains no doubt but that the instruments, as well as the method, furnish ample room for improvement and simplification." The simplification, I think, has now been reached, though of course, there is still ample room for improvement.

The steps in the development of gastroscopy are these:

Mikulicz determined one point, namely: that a gastroscope must be rigid, but he gave it a bend.

Rosenheim went a step further and said it must not only be rigid but should be straight, though he failed at times to introduce it without a bend. Now, I think, we are ready to add four more dicta:

1. Optic apparatus must be abandoned.
2. The tube must be passed by sight.
3. The stomach must be examined in a collapsed state, to permit of mopping, palpation with the instrument, probing, and combined endoscopy and external palpation.
4. General anesthesia is indispensable to prevent retching, during which the diaphragm clamps the tube, rendering exploration impossible.

CHAPTER XVIII.

The Usefulness of Gastroscopy.

Gastroscopy is not simply a feat. It has a field of usefulness that will increase as our skill and knowledge increase. Naturally, the tendency of everyone is to say that only in the obscure cases will gastroscopy be needed. Yet this opens a gap for the loss of the opportunity for an early diagnosis of malignancy, and pre-cancerous conditions.

When the gastroscope shall have reached its deserved recognition, patients will be examined gastroscopically sufficiently early to give the abdominal surgeon a fair chance. Better still, a positive diagnosis of pre-cancerous conditions will be made sufficiently early to enable him to save lives now being lost through reluctance of the patient to submit to an exploratory operation. Gastroscopy is not a substitute for exploratory celiotomy in every case.

Every surgeon knows the number of cases of malignant disease of the stomach that are fatal because the patients have refused an exploratory operation in the early curable stages. A large proportion of all cases of merely suspected malignancy will refuse to be (as they express it) "cut open to see what the matter is." They start out to find a man who can make a diagnosis without "cutting them open," and they soon find one who will give them the comforting assurance that they have no cancer and only need a little treatment. Thus their last opportunity is lost. If, however, it is proposed to pass an instrument through the mouth, consent will rarely be refused, especially when the patient realizes that one is going actually to *see* the conditions present. Indeed, the author has been begged in two instances by hopeless cases of cancer to examine them. He deemed examination inadvisable, lest their impending death might be attributed to the gastroscope, which at this stage should not be subjected to more than its share of criticism.

That the diagnosis of malignant disease of the stomach by symptomatic and chemical data is not always easy, even in the later stages, is shown by the following quotation from Riegel:

"There is another class of cancer cases in which the symptoms that are ordinarily considered characteristic for carcinoma are absent, but in which dyspeptic disturbances, loss of appetite, belching and general weakness appear."

In view of this, it would seem difficult by the common methods absolutely to exclude carcinoma in a patient past thirty years of age. All such cases then would seem to justify gastroscopy, rather than to be confronted with the necessity of revising the diagnosis later after treatment on the basis of a benign condition has failed to cure. By that time the patient will have become hopelessly inoperable, and his death will be due to the lack of an early diagnosis.

And this from Saundby:

"Since the era of stomach surgery we have learned how latent in certain cases the characteristic signs of cancer may be."

When the diagnosis is made from a palpable tumor, cachexia and the vomitus, it is useless, usually, except for prognosis.

In carcinoma of adjacent viscera, as of the spleen, where the healthy stomach wall is displaced, but not infiltrated, the normal stomach folds visible in the gastroscope will demonstrate the uninvolved condition of the stomach and thus aid, for instance, in the differential diagnosis between tumor of the spleen and tumor of the stomach.

In considering the possibilities of gastroscopy, the occurrence of tumors other than carcinomata and sarcomata must not be forgotten. The gastroscope renders it possible to take a specimen in cases of fibromata, myomata, lymphadenomata, etcetera.

One of the limitations of gastroscopy at present is the limited value to be placed upon negative results. Any lesion, if it exist in the explorable area, can be seen and, if advisable, felt, with the probe, and its nature determined; but if no lesion be found we cannot be certain that none exists in the unexplorable area. However, with improvements in technic this unexplorable area will be diminished.

When the gastro-enterologist shall have put the instrument into frequent use, it is reasonable to expect that our knowledge of the physiology and clinical pathology of the stomach will be greatly enlarged.

In peptic ulcer the gastroscope is of great service both for diagnosis and treatment.

Foreign Bodies. The feasibility of removing foreign bodies from the stomach has been demonstrated by the author. Any foreign body, the sharp points or edges of which can be guarded by the forceps or by the end of the tube, so as not to lacerate the esophagus, can be removed from the stomach with the aid of the gastroscope.

CHAPTER XIX.

Instruments for Gastroscopy.

The Gastroscope. To examine the stomach requires frequently an 80 cm. tube, though for many cases a 70 cm. length is sufficient. It is impossible to illuminate a field of view at this distance by any form of light projected in through the proximal end, for while the loss of light is not, with parallel rays and a polished interior, as the square of the distance, there is too great a loss for practical work. Kirstein's light, though excellent for other purposes, is useless for this great length. In addition to the loss by distance, there is the loss from slight springing of the tube and from bubbles in its lumen. These, while not interfering greatly with vision, do cut off much of the light projected in.

With the gastroscope shown (Fig. 17), the length of tube is immaterial. The view is as good at the end of an 80 cm. tube as that of a 45 cm. esophagoscope of the same diameter.

The construction of the instrument is the same as the bronchoscopes and esophagoscopes devised by the author.

In the wall of the gastroscope, as in the esophagoscope, there are made two small auxiliary tubes or canals. Both of these canals open into the main tube close to the distal end. One canal ends near the handle in a tip for the attachment of rubber tubing connected with the aspirating apparatus. This keeps the field clear of all fluids, and prevents smearing of the lamp. Large quantities of fluids have to be pumped out of the stomach in some cases.

The other canal is for the light carrier, which is a small removable double conductor carrying the lamp to the distal end of the instrument where it sheds its light at close range at the point where needed, leaving every object between it and the observer's eye in darkness.

The diameter of the lumen of the adult gastroscope is 10 mm. Many cases will permit a larger tube than this and the author uses frequently a tube whose outside dimensions are 11 mm. in one diameter by 14 in the other.

The distal end of the instrument is formed of a thickened ring to prevent injury to the tissues.

The exterior of the tube is not graduated. The depth is measured with a sterilized steel rule by noting the distance between the proximal end and the upper teeth.

Thus, 80—20=60 centimeters.

An obturator or mandrin with a projecting conical end is fitted to

FIG. 72.—The Clement Jones bougie for facilitating the introduction of the gastroscope.

facilitate the passing of the inferior pharyngeal constrictor, especially for those unfamiliar with esophageal work.

At the suggestion of Dr. Clement Jones, the Kny-Scheerer Co. have made a sound of 90 cm. in length (Fig. 72) to facilitate the introduction of the gastroscope at the hands of those accustomed to passing the stomach tube, but who are unfamiliar with the passing of rigid instruments.

CHAPTER XX.

Technic of Gastroscopy.

Anesthesia. Cocain in a courageous patient is sufficient so far as the pain of examination is concerned, but it does not stop the retching like deep general anesthesia. A large dose of morphin given hypodermatically assists. The stomach itself was altogether insensitive in the only case examined under local anesthesia by the author. Chloroform the author considers dangerous for esophagoscopic, and especially for gastroscopic, though not for bronchoscopic work. Deep anesthesia is absolutely necessary to prevent retching, which is to be avoided while the tube is in the stomach, both because it might be fraught with danger, and because it stops the examination by the diaphragm clamping the tube at the hiatus. Prolonged deep anesthesia is not safely maintainable with chloroform. Ether, then, is the choice, preferably started with nitrous oxide. A little chloroform may be given from time to time as relaxation is needed, especially in bad ether subjects. Dr. Boyce has demonstrated for the author, that chloroform is much preferable technically to ether, but this does not outweigh against the increased risk.

Once the patient is anesthetized, ether and the occasional few drops of chloroform are administered on several layers of folded gauze laid over the mouth, nose, gag and instrument.

Incidentally it may be said that considerable quantities of the anesthetic reach the stomach; whether it be swallowed or be excreted by the gastric mucosa, remains to be demonstrated; but certain it is that a strong vapor is ejected from the tube into the observer's eye during examination, and this seems to be the case regardless of the method of administration.

The preparation of the patient, is, in a general way, the same as for tracheo-bronchoscopy.

The essentials are an empty gastro-intestinal canal and a clean mouth. No food is allowed for twelve hours, black coffee and water may be taken within seven hours unless there have been symptoms of pyloric stenosis, in which case eighteen hours with nothing at all per os is essential.

Washing out the stomach is not a satisfactory substitute for fasting. When necessary, as in motor inadequacy, it should be done three or four

hours before the gastroscopic examination, so that the remains of food or fluid will have had time to be absorbed or to pass on. The author has discovered in gastroscopic investigations that after washing out the stomach there are from four to six ounces of fluid retained, pocketed off in the folds. The author has never seen an absolutely empty human stomach. There is always some fluid to be drained or pumped from pockets and valleys here and there.

Posture. The author's earlier work was done in a posture half way between the Trendelenburg and the horizontal, so that fluids drained away through the tube by gravity. But at the suggestion of Dr. E. S. Montgomery he has been using in some instances the reverse of this; that is,

obsolete

FIG. 73.—Position of assistants, nurses, operator and patient during the introduction of the gastroscope.

with the foot of the table lowered about fifteen inches. To do this, the aspirating apparatus has been improved so that every pocket is pumped out as soon as entered. This permits of a comfortable seat on a stool for the operator.

After the gastroscope is passed with the table horizontal, the plane of the whole table top is changed so that the head of the table is about 30 cm. higher than the foot. This would be too high for starting.

The position of the patient, operating table, operator, assistants, anesthetist, nurses and apparatus during the starting of the gastroscope is shown in Fig. 73. The diagram (Fig. 41) shows the positions more

accurately. These positions are absolutely essential, because of the length of the instruments. Otherwise everything will be in chaos.

Passing the Esophagoscope or the Gastroscope. The first essential is gentleness. If the tube does not pass readily it is either not in the right place or not rightly directed. The tube should be well lubricated with vaseline. The proximal end should be held lightly between the fingers of the right hand, the handle directed horizontally to the right as in Fig. 74, which shows the position as seen by the operator looking down upon it.

The forefinger of the left hand passes into the right glosso-epiglottic fossa, posteriorly to the lateral glosso-epiglottic fold, posteriorly to the tense pharyngo-epiglottic fold, and if possible into the right pyriform sinus.

The tube then is made to follow this same route, while the finger

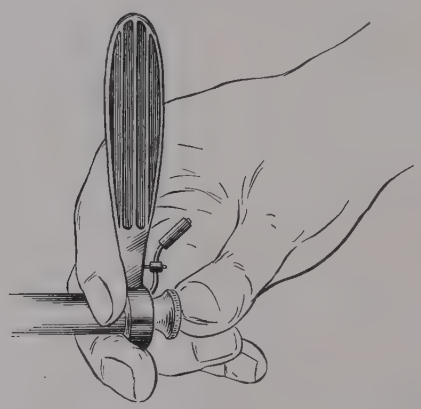


FIG 74.—Position of the right hand during the introduction of the gastroscope, viewed from above by the operator looking downward.

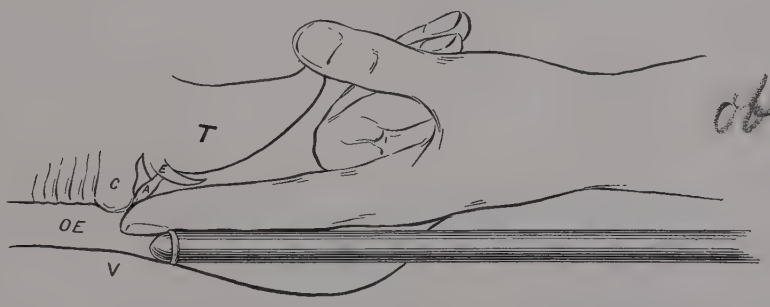
slides toward the median line and lifts the tongue and anterior pharyngeal tissues upward (dorsal decubitus). When the cricoid cartilage can be reached, which is possible usually only in children, it is better to lift upon it directly (Fig. 75). When impossible, as it is usually in adults, the cartilage must be lifted indirectly by traction upon the tissues at the extreme point reachable, often the right glasso-epiglottic fossa.

The introduction of the gastroscope is easy to one accustomed to the esophagoscope, and is readily learned by any one. Personally the author prefers using one index finger as a guide. Some may prefer starting the instrument by sight, without the obturator as in bronchoscopy; others may prefer threading the instrument over an esophageal bougie as suggested by Dr. Clement R. Jones. Whichever of these methods be used, as soon as the introitus is passed the instrument must be guided by sight to make a safe procedure.

The neck of the patient is bent backward to straighten the cervical curvature, or rather to cause the axis of the oral cavity to approach parallelism with that of the esophagus. This also moves the upper teeth as much as possible out of the way of the tube.

In bending the neck the angle should be as much as possible at the upper cervical vertebræ so as to straighten the oro-pharyngeal angle as much as feasible, while keeping the pharyngeal axis as straight as it can be kept. After the tube is started the head may have to be raised (supine patient) slightly to prevent tracheal compression.

Dr. Boyce has developed the details of holding the head to a degree



obsolete

FIG. 75.—Diagramatic position of the left hand in starting the esophagoscope or gastroscope.

of perfection that makes all endoscopy *per os* easy. It is more difficult to teach an assistant how to hold the head than to teach him endoscopy. The following is a description of the correct position.

DUTIES OF THE SECOND ASSISTANT IN ENDOSCOPY *PER OS.*

BY DR. JOHN W. BOYCE.

In all this work safety demands that the mouth, pharynx, and esophagus be brought into a straight line, not by a crowbar like action of the tube, but by holding the head steadily in extreme extension with the mouth widely open. Not only does lateral pressure add to the operator's difficulty, but it also entirely prevents any sense of what the point of the tube is touching. Trial with an unanesthetized patient will show that if the head is simply allowed to hang over the edge of the table, not only is an unnecessary strain thrown upon the ligaments of the neck, but full extension is not as well secured as by proper support of the head. It is further to be remembered that no mouth gag is absolutely self-retaining and a slight slip while the tube is in position may have serious consequences. For this reason it is best to detail a second assistant to hold the head and steady the mouth-gag, impressing him with the importance of the matter and his entire responsibility therein. To carry him out of the operator's way it is necessary that he shall hold the head at arm's

length and to hold it in this position steadily for fifteen or twenty minutes a support is necessary. The weight of the head is so little that the matter seems easy, but if the assistant's arms are unsupported, about the time the most critical point of the examination or operation is reached his muscles will be trembling. Nor is it possible to rest him by any shift of position after the tube is started. After many unsuccessful trials, it has been found that the best position is as shown in Fig. 76. The patient is drawn forward until the tops of his shoulders clear the table by from four to six inches, and the mouth-

FIG. 76.—Position of second assistant and patient for endoscopy per os. Gowns, caps and covers are omitted better to show the positions.

gag is inserted on the left side. The assistant is placed on the right side of the patient's head on a stool of appropriate height, as though on a side saddle; his right leg beneath him in the kneeling position, his left foot supported on a stool 26 inches lower than the top of the table; his right forearm is passed beneath the patient's neck, supporting it; his right hand grasps the mouth-gag drawing it strongly backward. His left hand rests on the left knee, grasps the head strongly at or in front of the bregma, bending it backward and exerting a certain degree of upward pressure. The exact proportion of backward and upward pressure cannot be described, but is readily appreciated on trial, es-

pecially if the assistant has actually experienced the difference in sensation when the head hangs free and when it is properly supported in extreme extension.

After the introitus is passed, the obturator is removed, the cord is attached to the light carrier by the bayonet fitting, which by rotation is used as a switch to turn on and off the current, the rheostat on the battery having been previously regulated to full illumination when the instruments were prepared. Turning the bayonet fitting now lights up the instrument and the passing is under the guidance of the eye, the sense of touch only being used to note resistance, which if felt, means something to be overcome by skill, not force. Once started, the passage of the instrument down the esophagus is easy if three important points are watched:

1. The instrument must have been well greased before starting.

2. The tube must be guided by the eye so as to follow the esophgeal lumen by sight.

3. The pinching of the tube by the teeth must be avoided so that the tube will be free to move as needed to follow the axis of the esophageal lumen as it is seen to open up ahead.

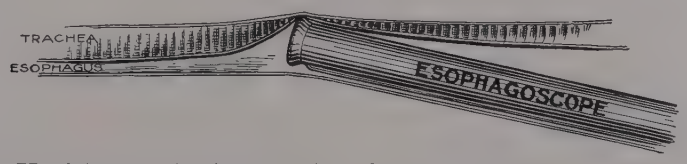


FIG. 77.—Diagram showing occlusion of the trachea by faulty direction of the gastroscope (or esophagoscope).

4. The holding of the head must be exactly as just described by Dr. Boyce.

After passing the introitus care must be taken to raise the head of the patient slightly to prevent the tube pressing on the trachea (Fig. 77). This is readily noticed if the passing is done by sight.

In finding the lumen the normal respiratory movements are of great assistance. The way often seems to be completely blocked ahead by what seems to be the esophageal wall, but with the next inspiration a lumen appears in one or other quadrant of the tube, a few bubbles are seen, and the tube is readily glided along.

The introitus passed, only two points will give any trouble. The first is at the hiatus diaphragmatis, the second the bend of the abdominal esophagus to the left. The hiatus is passed by placing the long axis of the elliptic cross section of the tube from the right posteriorly forward toward the left anteriorly. This is easily done by placing the handle of the gastroscope in the direction of the visual axis of the patient, if he were

looking forward (if erect) to the left. The axis of the hiatus is shown in Figure 59.

Full relaxation assists passing both the hiatal narrowing and the abdominal esophageal bend.

The abdominal esophagus is readily passed if the head and neck of the patient are moved to the right (Fig. 78) and the lumen is carefully watched and followed. The difficulty met here is very much like the folding over of the trousers when the foot is not inserted in the right direction.

If any serious difficulty is experienced in passing the hiatus, it will be found, usually, that the patient has come partially out. Upon deepen-

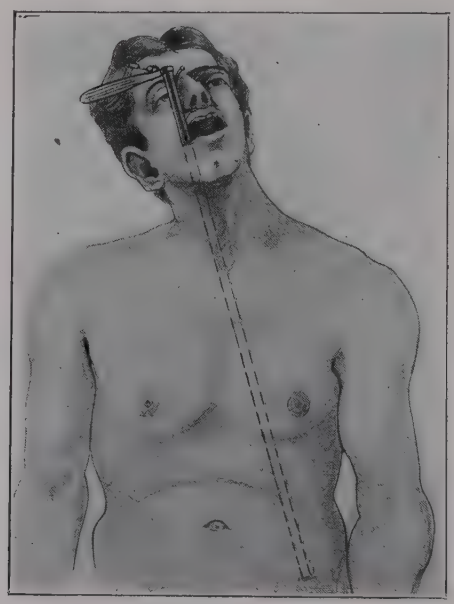


FIG. 78.—Schema. Head and neck moved to right to reach left limit of the explorable area; also, during introduction, to pass through the hiatus and abdominal esophagus.

ing the anesthesia the gastroscope will glide easily through the hiatal esophagus into the subphrenic portion if the lumen be watched for through the tube and followed. This involves a lateral drag. After the distal end of the tube is in the stomach, the exploration is easily accomplished if a systematic plan be followed. From one to six square centimeters are visible at one time, so that a systematic plan of tube travel has to be followed to be reasonably certain of examining all portions of the ventricular mucosa.

There are two plans of exploration, both of which should be carried out. First the gastroscope should be passed down carefully and gently to the greater curvature, inspecting the anterior and posterior walls. At times these walls do not seem to be fully collapsed ahead of the tube and one will have to be examined first, then the other. Then the tube is withdrawn, inclined slightly laterally in the same plane, then pushed gently downward again in a new series of folds. This is repeated until the extreme pyloric limit is reached. To reach this limit the head and neck of the patient are moved to the left (Fig. 79) with the tube below the cardia.

After the whole possible range has been covered in this way, we pro-

FIG. 79.—Schema. Head and neck moved to left to reach right limit of the explorable area.

ceed to the second plan. The tube is passed down until the extremity touches the wall of the greater curvature in the extreme left of the possible field. Then the tube is moved slowly along the greater curvature, but not in too close contact therewith, until the extreme right is reached. Withdrawing the tube a centimeter or two, the field is slowly swept again in the same plane, but at a higher level, and so on upward to the cardia. Next the deft fingers of one skilled in abdominal palpitation are called upon to manipulate the unexplored portions over in front of the tube. This is sometimes better accomplished by turning the patient on his side,

first on one then on the other. During all these manipulations the tube must be withdrawn within the esophagus. When the stomach is in its new position the gastroscope is again pushed downward and the newly available surfaces are explored. Should retching supervene while the gastroscope is in the esophagus, no harm will result, but when the tube is in the stomach, retching is the signal for immediate withdrawal of the gastroscope until the distal end of the tube is above the diaphragm. No harm has been done in a number of the author's cases where retching has occurred with the tubal extremity in the stomach, yet it is to be regarded as dangerous in diseased conditions at least, and to be avoided in all cases.

The vertical diameter of the stomach is easily determined by measurement. The depth from the teeth to the cardia is taken, then the gastroscope is pushed on down until the greater curvature is encountered and the distance from the teeth again is taken. The difference between this and the first measurement gives the vertical diameter of the stomach at this point. Care must be used that the measurements are not rendered inaccurate by pushing the greater curvature downward, which is exceedingly easy to do without knowing it, if the sense of touch is relied upon to determine when the lower wall is reached. If the downward progress of the gastroscope is watched through the upper orifice, it is easy to see when the wall at the greater curvature is touched. Having taken our measurements, we then place the obturator externally parallel to the tube within and indicate to the abdominal manipulator the exact position of the lower end of the tube which he can then mark on the skin, giving thus with absolute certainty the exact location of the greater curvature of the empty stomach at that point. Care must be taken of course to re-sterilize the obturator should it touch anything unclean.

The smallest vertical diameter found by the author in any adult was 4 cm. (1½ inches) and the greatest 36 cm. (14 inches).

There is a tendency for the gastric walls to be dragged along with the tube when the tube is moved, so that we shall not get a full new area unless care be taken. Withdrawal for a few cm., followed by re-insertion, allows the walls to regain their average place.

The time required to examine the entire explorable area is about thirty minutes, if there are no interruptions.

CHAPTER XXI.

Area of the Stomach Explorable by Gastroscopy.

It may be accepted as an axiom that the more horizontal the stomachal position the less will be the explorable area. Thus gastroptotic, vertical and infantile-form stomachs afford the greatest range. The reason for this is at once apparent when we consider that the lateral range of motion is that of the hiatus esophageus.

The lateral distance to which this hiatus can be shifted varies with the individual, being greatest in feeble, elderly, emaciated patients; and with the depth of anesthesia, being greatest in profound chloroform anesthesia. The antero-posterior mobility of the hiatus is of little use (except as facilitating the passing of the tube at this point) for the surrounding viscera crowd the stomach walls in ahead of the tube, and usually both anterior and posterior walls are visible at one time.

The pivotal point of rocking of the gastroscope is somewhere in the thorax, not, as might be supposed, either at the upper thoracic aperture or at the hiatus esophageus. (Schema, Fig. 80.)

The full range of the upper thoracic aperture is available by shifting the whole head and neck laterally, as well as, in some cases, slightly antero-posteriorly. (Fig. 78 and 79.)

The radiograph (Fig. 81) by Dr. Boggs, taken in the living under ether, shows the range of motion of the gastroscope in this particular case of gastroptosis, which was not a very good one for demonstration, as relaxation was not complete and the diaphragm hampered movement.

Ordinarily there is no difficulty in making the tube point in turn toward the right and the left anterior superior spine of the ilium. The greater curvature of the stomach can be forced down to this level in almost any case and in ectasia into the pelvis behind the tubes. But in this case no force was used, and it was not a case of ectasia. The end of the tube (Fig. 82) shows the position of the pyloris in this case.

If the diaphragm were rigid, gastroscopy would be very much hampered. But it has, when the patient is fully relaxed under anesthesia, a

range of flexibility that may be averaged roughly at a 5x15 centimeter ellipse, the long axis being laterally, and a very slight antero-posterior rocking will bring either the anterior or posterior wall into view alone.

In one gastroptotic stomach the author succeeded in exploring about the entire mucosal area. In one instance, a horizontal stomach, not more than one-third of the stomach could be explored.

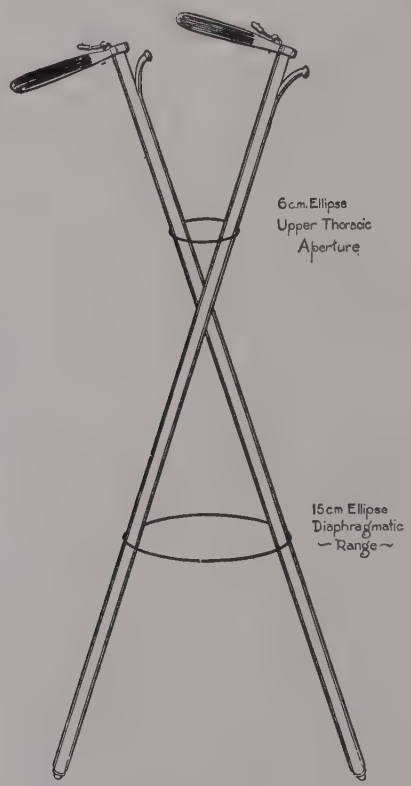


FIG. 80.—Schema. Showing extreme right and left positions.

In the foregoing remarks reference is had only to cases in which the esophagus is normal. Anomaly or organic disease of the esophagus may render esophagoscopy and gastroscopy difficult or impossible.

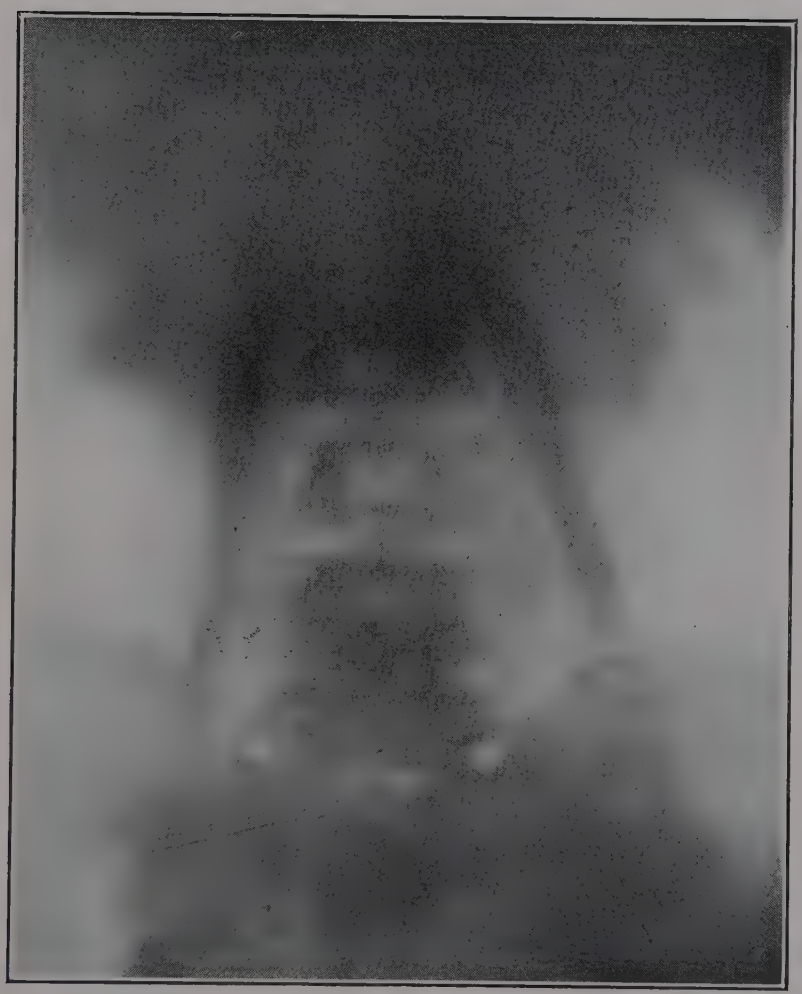


FIG. 81.—Radiograph of gastroscope in two different positions, in a case of gastroptosis, the patient under ether. Shadow of coin locates the umbilicus. (Radiograph by Dr. Russell H. Boggs.)

FIG. 82.—Radiograph of gastroscope in position in the living patient. Tube mouth in the pyloris (gastroptosis). Shadow of coin locates the umbilicus. (Radiograph by Dr. Russell H. Boggs.)

CHAPTER XXII.

Difficulties, Dangers and Contra-Indications.

Difficulties. When it is said that gastroscopy is easy, it is not meant that no training is necessary. One does not learn ophthalmoscopy in a day. Yet so far as seeing the tissues is concerned, gastroscopy is the easier.

There are two classes of difficulties. They are both slight and easily surmounted. One class concerns manipulation, including introduction and exploration, and the other class concerns the eye, which consists in comprehending the picture.

Those physicians who have looked through the instrument at the stomach mucosa without any previous training at tube work, or at ophthalmoscopy or microscopy, have been able to see clearly. Some of these same men have said that they cannot tell, on looking into an ear, what is drum membrane and what is canal.

Naturally, those accustomed, like the laryngo-rhinologist, to viewing deep-seated mucosæ with one eye, while relaxing the accommodation of the other eye, and ignoring its image will be enabled to see at a glance.

His experience in intubation and in esophageal work will also make him facile at passing the instrument.

By this it is not meant that gastroscopy should be done by the laryngologist. On the contrary, it is the province of the gastro-enterologist, the physician and the surgeon. None of these will have the slightest difficulty in acquiring the necessary technic, and manual dexterity.

Lordosis, Potts disease and other morbid conditions of the vertebræ may make gastroscopy impossible.

Dangers. In careful hands there is no danger other than that of ether anesthesia.

In general, it may be stated that the stomach is a very much less sensitive organ than the esophagus; not only less sensitive in the strict meaning of the sensation, but in the matter of efferent impulses for the production

of reflexes, and of congestion and inflammatory reactions to local irritations.

As the real question of importance is as to shock incident to the passing of a rigid instrument through the entire length of the esophagus, (which, a priori, would seem the only question of importance as the stomach is quite insensitive) a number of sphygmomanometric observations upon the author's cases were made by Drs. Boyce, Barach and Upham. The analysis of these observations was published in the Medical Record, from which the following is quoted:

"Gastroscopy is apt to be done under very shallow anesthesia, and the pressure curve is particularly likely to be distorted by accidental circumstances, but in the four cases observed, the readings were fairly uniform, and it seemed safe to say that there is ordinarily no appreciable disturbance of the circulation, but that in an occasional case the characteristic esophageal fall will occur from the passage of a rigid instrument of this length. In these cases, however, the pressure does not remain at the low point, but starts to rise at once and reaches the original level while gastroscopic search is in progress."

Gastroscopy certainly is not as dangerous as passing a sound or tube, for all diseased spots are seen and pressure upon them avoided. Thus in malignant disease of the cervical esophagus, the natural constriction at the introitus is increased, and carelessness might force a stomach tube through, but with the rigid gastroscope passed by sight the growth at once is discovered. As stated, the tube is started with the finger, and a previous laryngoscopic examination is relied upon to exclude disease of the introitus. Dysphagia without regurgitation is usual in disease of the upper esophagus; so that in dysphagia with regurgitation we may safely conclude that the disease is far enough within the esophagus to allow the tube to be started by the sense of touch without reaching the diseased tissue.

Mikulicz doubted the safety of examining cases of suspected malignancy, and doubtless he was correct, with his instrument with its bend which had to be swung with necessarily imperfect control, and most important of all without seeing what the end was doing. With a perfectly controllable straight instrument unobscured and unweighted with a telescopic optic apparatus, the touch is gentle, certain and under full control.

Suspicious spots can be seen and pressure upon them avoided. Disease of the abdominal esophagus, which makes a more or less sharp turn, (relative to the advancing tube) would be particularly dangerous with an instrument passed blindly.

As to the danger of taking a specimen, the author has done so in a number of cases without any ill result. They were all cases associated with fungation. It is wise, probably, not to remove a specimen from the

edge of any flat ulceration, as there might be some risk of perforation, or possibly of hemorrhage.

The foregoing statement of dangers is based upon the utmost gentleness of manipulation under the relaxation of deep anesthesia; the passage of the gastroscope by sight; the withdrawal of it within the esophagus, should retching supervene; and upon the strict observance of all the minor details already alluded to.

Contra-indications. While, as stated, there is practically no danger, there are certain cases where gastroscopy is not advisable. In the profound cachexia of the last stages of malignancy; in the profound anemia of inanition from known or unknown cause; cardiac, pericardiac or major vascular lesions; general or local, acute or chronic conditions associated with either dyspnoea or dropsical effusions; the late stages of organic diseases, as cirrhosis of the liver, nephritis, etc.

It will be noted that all foregoing conditions are really contra-indications to anesthesia.

While it is by no means certain that even in these cases there is any danger other than that of anesthesia, it is prudent to be particularly careful, in the early development of gastroscopy, not to risk a death that, rightly or wrongly, would be attributed to the procedure and not to the anesthetic or the concomitant aneurysm or other lesion, thus attaching a stigma of danger to a safe and useful procedure.

CHAPTER XXIII.

Gastroscopic Appearances.

In describing and illustrating what he has seen, the author wishes to point out that these may not be usual or average appearances. They are only descriptive and illustrative of these particular cases. Not until at least a thousand cases have been examined can any one say what is the average or usual appearance of normal and pathologic conditions. Nor, until then, can any one properly classify the latter. This opens up an enormous field for research.

There are many difficulties in the way of reproducing the gastroscopic views. These difficulties have been surmounted so far as possible in the accompanying color drawings which were made by the author from memory after the examinations. They are only a few of thousands of pictures.

Normal. The folds of the stomach form an endless variety of pictures in front of the gastroscope. A hundred or more different views are presented at a single examination. Not that the folds themselves vary so much, but the manner in which they are presented to the tube varies.

There is one horseshoe-shaped form (Figs. 4, 16 and 18, Plates IV and V) that is often seen, especially near the cardia. It seems to come most often from the lesser curvature, and to be formed by the tube mouth encountering a fold at nearly a right angle to the side of the fold. In some instances it may be formed at the branching of a fold.

When the tube mouth enters the cardia the folds seem to extend downward away from the tube and parallel with its axis, and the tube enters upon a half-open tunnel, the walls of which are formed by longitudinally arranged ridges separated by narrow and deep valleys. The sense of depth of the tunnel is difficult to portray. Proceeding on down this tunnel the ridges show a lateral trend and we suddenly end with a blank, sometimes mottled surface, rather flat, sometimes slightly ridged. It flattens and blanches as we proceed downward, for although we have encountered the wall of the greater curvature of the stomach, we do not

realize it at once by the touch as we push it on downward for ten or more centimeters before resistance is felt, if the patient be fully anesthetized. If the patient comes out partially and begins retching resistance is at once felt, but less than might be expected.

When the tube is withdrawn the disk of flattened stomach wall follows the tube mouth in close contact to a position sometimes higher than where it was encountered.

Landmarks, among these folds, in size or direction, will be discovered, probably, but as yet orientation is difficult except by the general sense of direction and distance from the cardia. This is difficult to estimate because of the dragging along of the walls by the tube.

In addition to the change in form of the folds by the pressure of the tube, variations are caused by the various movements.

The movements of the stomach are constant. They may be classified into respiratory, pulsatory, anti-peristaltic and peristaltic. The latter class possibly includes different motions which further work will analyze. Of the anti-peristaltic movements there are two kinds, the duodenal variety being limited to the pyloric end and the vomitory to the fundal half. Other movements of the stomach resulting from, apparently, the activity of its own muscular fibres, are frequently seen, and may be classed as peristaltic, but may be due to the communicated movements of adjacent intestines.

The respiratory movements in the stomach are not so marked as those in the esophagus. They seem to produce alternately negative and positive pressures. They are sufficient to cause an in-and-out flow of air, the outflow being strongly saturated with the vapor of the anesthetic which is present in considerable quantity in the gastric secretions.

The pulsatory movements are transmitted from the heart and to a great extent from the descending aorta. The impulses are not so strong as those in the esophagus where the aorta is crossed.

The pyloric third is the most unstable portion of the stomach. In one instance the pylorus was surrounded by a rosette of annular folds. In another case the folds were seen to be larger as the pylorus was approached. These folds would curve in ahead of the tube, then be pushed aside by the advancing tube mouth. Finally one large fold was moved aside and a slit something like Fig. 25 came into view. Almost immediately it resolved itself into a rounded opening which receded into a cup-like depression followed by the wrinkling into the tube of numerous small folds as shown in Fig. 26, accompanied by the exuding of a dram or two of dark cloudy olive-colored fluid. This evidently was an anti-peristaltic movement, and it immediately preceded retching.

This was at the apex of the interior of a hollow cone, the walls of

which the tube had followed. The question arose in the author's mind whether this was the pylorus, or the constriction of an hour-glass contraction, or the kink of a gastroptotic stomach. Either of the latter might show a narrowed opening lying at the apex of the interior of a hollow cone, with a reverse flow of fluid exuding, and an hour-glass contraction might show the depth beyond; but the question was decided when the small, annular duodenal folds beyond were seen, and no doubt remained when these folds wrinkled up, came toward the tube and filled the opening.

There seemed to be a degree of rhythm in the movements of the pyloric end of the stomach in one case, but the author could not be certain. It was a much slower rhythm than that of the heart, the movements being a minute or two apart. Whether the presence of the tube was a factor in their production or not, could not be determined.

The line of demarcation between the esophageal and the gastric mucosa is sometimes one of strongly constrasting color. The gastric mucosa varies more in tint than does the esophagus, probably on account of its greater vascularity. It is at times a deep crimson and then the contrast with the pale pink mucosa of the esophagus is marked. The contrast is represented by writers on esophagoscopy as much greater than it really is, because the writers have never seen it except by endoscopic tubes that use reflected light projected down into the tube from without. This brings out the esophageal margin in pale pink, while the insufficiently illuminated depths of the stomach are all in dark shadow if indeed they can be seen at all, and thus the true color of the gastric mucosa has never been seen properly illuminated.

While in some cases it is a very dark, deep crimson, it is quite often very pale pink. In one case, the color of the stomach about an hour after taking a glass of milk was crimson (Fig. 16, Plate III), due to the engorgement of active function from the presence of food. Half hour after vomiting the milk the mucosa was very pale.

In another case, the mucosa was this same color four hours after taking chicken soup, but as whiskey had been taken about one hour before this may have influenced the vascularity and consequently the color. There was carcinomatous pyloric stenosis, also, in this case, with consequent feeble motility.

In many cases of foreign body in the esophagus the author has used a gastroscope instead of an esophagoscope, and after removing the foreign body has taken a look at the gastric mucosa by passing the cardia. These were presumably healthy stomachs, and from these experiences, as well as the views obtained in cases where only cardiospasm and esophagismus were found, he has come to the conclusion that when the stomach is empty its mucosa varies from pale red to pale pink. The color seems deeper in

ether anesthesias than when chloroform is used, probably due to the greater engorgement of the stomach vessels. Possibly it may be the ether present in the stomach. It was much less deeply colored than in the two cases examined after eating food.

The gastric mucosa as seen through the gastroscope presents a moist appearance, but it has a more velvety, less glistening, and less transparent look, than the upper mucosæ.

The visibility of the minute arterial twigs is a matter which affords great opportunities for investigation.

Vessels are not usually visible through the gastroscope in the normal gastric mucosa when the stomach is empty, as it usually is when examined gastroscopically. In the instance where the author has seen vessels, there was reason to believe that recent taking of food or presence of ether itself or of ether intoxication has engorged the vessels. Yet in some cases no vessels were visible.

In one case where the gastroscope was passed under cocain and morphin anesthesia for a foreign body in the esophagus, after removing the foreign body, the tube was passed on down a few centimeters distance into the stomach and arterial twigs were noted in a number of locations. There were no stomach symptoms in this case, and no secretion that lead one to think that a lesion might have existed.

Gastritis. In one case the mucosa was covered everywhere with thick pasty secretions that looked like an exudate and was very difficult to wipe away. In another case the secretion was in patches. Swallowed muco-pus was seen in several cases without gastritis lying free, not adhering; so that there is no danger of confusing swallowed mucus with that of the stomach.

The color of the mucosa was a darker red in one case than seemed normal, and the mucosa seemed thickened. In only one of these cases were there dilated capillaries such as are seen in chronic inflammation of the esophagus.

Many more cases will have to be examined before definite diagnostic appearances can be classified. This will be but a matter for repeated examinations, for the view is as clear as we get of other mucosæ, chronic inflammations of which are apparent at a glance.

Peptic Ulcer. The gastroscopic appearance of benign ulcer was different in each case. The first one seen (Fig. 11, Plate IV) was a dirty grayish yellow, (color in the figure is too bright) not apparently punched out and not infiltrated. But at the time, the author hesitated to touch an ulcer, and did not mop the surface.

In the second case (Fig. 28, Plate V) there was very little secretion, and after wiping the surface it was dark in color, did not bleed, and was

sharply punched out in appearance, the edges being slightly infiltrated. In another case (Fig. 27, Plate V), there was a dark longitudinal slit on the crest of a ridge which looked like an ulcer, but as it was necessary to terminate the examination, it was not possible to determine for certain. There was a cancer in the stomach, but this slit was not part of the growth and was in an otherwise normal fold.

In another case(Fig. 15, Plate III) the ulcer bed was dark, somewhat rough and without any secretion or debris in its cavity, and it required no mopping.

Malignancy. The gastroscopic appearance of malignant neoplasms varies widely, not only in different cases but in different portions of the same lesion. In all that have been observed, however, there is marked contrast with the normal mucosa that is very striking. Not only the normal folds are gone, but the surface of the lesion is irregular and granular or nodular. In most instances it was covered with secretion varying in color from white through gray and yellow to pink, red, crimson, purple and brown.

The secretion is sometimes mottled with brown flakes.

In the first two cases examined (Figures 14 and 15, Plate IV), the author hesitated to remove this secretion lest hemorrhage be started. In the later cases, however, it was found that wiping away the secretion gently did not produce hemorrhage, and a better view of the colors of the lesions themselves was thus obtained.

These colors vary widely not only in different lesions but in different parts of the same lesion. In one case the color varied in different parts from pale grayish yellow to pink, deep red, crimson, and brown, with a number of patches of small brown and crimson points apparently where hemorrhages had occurred. One portion of this mass after wiping looked like an over-ripe mulberry. This was beautifully shown at one point where a nodule of this mass came out in contrast with the normal pale red mucosa beyond (Fig. 18, Plate III).

In one case a portion of the growth external to the stomach wall could be felt, with gastroscope and probe, as a densely hard mass, yet the overlying mucosa was normal as to folds and color (Fig. 20, Plate V). In another portion the color was normal but the folds were absent. In this portion the muscular wall was evidently involved but the mucosa was not. (Fig. 48, Plate V.) These points, I think, promise to be of great value in differential diagnosis between lesions of the gastric wall and lesions of neighboring tissues displacing the uninvolved gastric wall inward.

Vessels were seen in a number of locations in two cases of malignancy, one of these showing a well marked zone. (Fig. 17, Plate III.)

The sense of touch as transmitted through the tube is a remarkably

efficient aid in the diagnosis of malignancy. In one case (Fig. 34, Plate V) the hardness of the mass shown to the right in the plate was diagnostic, as was also the mass shown to the right in Fig. 13, Plate IV.

Gastroptosis and Gastrectasia. The position of the greater curvature is always easily determined, as is also the vertical diameter of the stomach.

These data are, of course, insufficient to differentiate between an ectatic and a gastroptotic stomach. If we can reach the pylorus, the diagnosis is clear. The position of the lesser curvature which is the diagnostic point and which is difficult to determine clinically, is very readily determined gastroscopically in gastroptotic or infantile stomachs. If the lesser curvature is far from vertical its position cannot be accurately determined, as in this case it can be inspected by external abdominal manipulation, which, of course, gives no idea as to its usual position.

The recent developments in Roentgenography lessen the value of gastroscopy in the diagnosis of anomalies or abnormalities of position. Authorities state that the lesser curvature is difficult to show, by the bismuth method, and the air, gas or water methods cause displacements; and, further, that the Roentgen process is difficult in the very stout. If these things be, gastroscopy can supplement Roentgenography in many instances.

BIBLIOGRAPHY.

TRACHEO-BRONCHOSCOPY.

(1) *Barret,* Extraction d'un corps etranger du bronche droit par bronchoscopie superieure. Gaz. des hopitaux, Tome LXXVIII, Nr. 28, 9. Marz 1905.

(2) *Beclere,* M. A., Le radiodiagnostic des corps etrangers des bronches. Presse Medicale 1903, Tome XI, Nr. 103.

(3) *Behnstedt,* H., Eiserner Hacken in der rechten Lunge mit Hilfe der Bronchoskopie diagnostiziert und extrahiert. Inaug.-Diss., Kiel 1904.

(4) *Birch-Hirschfeld,* Uber den Sitz und die Entwicklung der primaren Lungentuberkulose. Arch. fur klin. Medizin 1899, Bd. LXIV, S. 79 u. 80.

(5) *Bodmer,* Entfermung eines Fremdkörpers aus dem rechten Bronchus mit Hilfe der Killianschen Bronchoskopie. Schweizer. Korrespondenzblatt, Nr. 6, 1904.

(6) *Borchardt,* Fremdkörper im Bronchus. Sitzungsbericht der Freien Vereinigung der Chirurgen Berlins vom 9. Januar 1905; s. Deutsche medizin. Wochenschrift, Nr. 10, s. 404, 1905.

(7) *Botella,* E., Traqueoscopia, Bronchoscopia y Esofagoscopia. Boletin de Laringo-logie Mai-August 1905.

(8) *Borger,* Fremdkörper in den Lutfwegen. Sitzungsbericht der Gesellschaft für Charitearzte vom 23. November 1905.

(9) *Brindel,* Un cas d'atresie de la trachee et des grosses bronches par neoformation sleremateuse d'origine traumatique. Rev. hebdom. de Laryngol. vom 11. Marz 1905.

(10) *Burk,* W., Ueber einen Fall von Fremdkörperextraktion aus den Luftwegen mittelst eines Elektromagneten. Arch. für Laryngologie, Bd. XVII, Heft 1, 1905.

(11) *Bevan,* Lancet, 1868, p. 470.

(12) *Bozzini,* Ph. Weimar, 1807.

(13) *Caquin,* L., Bedeutung der Radioskopie und Bronchoskopie für die Diagnose der Fremdkörper in den Luftwegen. These de Paris, Juni 1904.

(14) *Chiari,* O., Entfernung eines Knochens aus dem rechten Hauptbronchus. Sitzungsbericht der k. k. Ges. der Arzte vom 16. Marz 1906; s. Weiner klin. Wochenschrift Nr. 12, S. 351, 1906.

(15) *Chiari,* O., Entfernung eines Fremdkörpers (Fruchtschale) aus dem rechten Hauptbronchus. Sitzungsber. der Wiener laryngol. Gesellschaft vom 4. April 1906; s. Wiener klinische Wochenschrift, Nr. 31, S. 969, 1906.

(16) *Coolidge,* A., Removal of a foreign body from the bronchial tubes through the tracheal opening. New York Medical Journal vom 30. September 1899, S. 475.

(17) *Coolidge,* A., Three cases of foreign bodies in the bronchus. Report of the American Laryngological Association, Juni 1903.

(18) *Coolidge,* A., Foreign bodies and Tracheoscopy. Sitzungsber. der XXVIII. Versammlung der Americ. laryngol. Association, Mai 1906.

(19) *Chiari,* O. Krankheiten des Kehlkopfes und Luftröhren, 1905.

(20) *Coolidge,* A. Boston Med. and Surg. Jour., May 25, 1905.

(21) *Coolidge,* A. Boston Med. and Surg. Jour., October 13, 1904.

(22) *Crile,* G. W. Med. News, January 27, and February 24, 1900.

(23) *D'astros et Molonie,* Corps etranger de la bronche droite, extraction par bronscopie directe. Marseille Medicale, Dezemberheft 1904.

(24) *De Carli,* D., Federici F., Melzi u. Tanturri D., Corpi stranieri nella laringe, trachea e bronchi. Referat erstattet am X. Kongreb der Societa Italiana di laringoloia, etc.; Mailand, 17.-19. September 1906.

(25) *Denker, A.,* Ueber Extraktion von Fremdkörpern aus der Speiseröhre und der Luftröhre vermittelst der Osophagoskopie und der Tracheoskopie. Archiv für Laryngoloie, Bd, XVII, Heft 1, 1905.

(26) *Dreyfuss,* Diskussion zu einer Demonstration von Manasse. Sitzungsbericht d. Arztevereines in Strassburgh vom 27. Mai 1905; Deutsche-med. Wochenschrift, Nr. 38, S. 1521, 1905.

(27) *v. Eicken,* C., Ein Kragenknopf im linken Hauptbronchus. Beitrage zur klin. Chirurgie, Bd. XXXIV, S. 427, 1902.

(28) *v. Eicken,* C., Entferung eines Knochenstückes aus einem Bronchus des rechten Unterlappens auf natürlichen Wege. Deutsche med. Wochenschr., Nr. 23, 1903.

(29) *v. Eicken,* C., Die klinische Verwertung der direkten Untersu-

chungs-methoden der Luftwege und der oberen Speisewege. Archiv für Laryngologie, Bd. XV, Heft 3, 1903.

(30) *v. Eicken,* C., Beitrag zur diagnostischen Bedeutung der Radioskopie bei Stenosen der Luftröhre. Sitzungsber. der XIII. Versammlung süddeutscher Laryngologen zu Heidelberg, Juni 1906.

(31) *Elsberg,* Chas. A., Entfernung eines Fremdkörpers aus dem rechten Bronchus im Wege der unteren Methode. Larynkoskope, H. 12, 1905.

(32) *Engelmann,* Fremdkörper im Bronchus. Sitzungsbericht des Hamburger arztlichen Vereins vom 2. Mai 1905; Münchner medizin. Wochenschrift, Nr. 19, S. 933, 1905.

(33) *Eiborn,* Berlin klin. Woch., 1902, No. 51.

(34) *Finaly,* G., Ueber direkte Oesophagoskopie und Bronchoskopie. Budapesti Orvosi Ujsag, Nr. 50, 1905.

(35) *Fletcher Ingals,* E., Oesophagoscopy and Bronchoscopy. Journal of the American Medical Association vom 19. November 1904.

(36) *Fletcher Ingals,* E., Bronchoscopy for foreign bodies in the bronchial tubes. Illinois Medical Journal, Dezemberheft 1904.

(37) *Fletcher Ingals,* E., Bronchoscopy for removal of foreign bodies from the lung. New York Medical Journal vom 8. und 15. Juli 1905, so wie Journal of the American Medical Association, Nr. 21, 1905.

(38) *Ingals,* E. Fletcher, Respiratory movements of the bronchial tubes. Journal of the American Med. Association vom 28. Oktober 1905, S. 1302.

(39) *Fonce,* M., La laryngo-tracheo-bronchoscopie. Thèse de Paris, vom 18. Juli 1905.

(40) *Garel,* J., Clou fixe dans la bronche droite depuis deux mois. Lyon medical Nr. 1, 1901.

(41) *Garel,* J., Deux cas de corps etranger du larynx. Lyon medical, vom 10. Dezember 1905 und 4. Februar 1906.

(42) *Garel,* J. et Durand, M., Une epingle dans une bronche de troisieme ordre; extraction a la bronchoscopie inferieure. Lyon medical, Nr. 24, vom 12. Juni 1904, S. 1157.

(43) *Garel, J.,* Oesophagoscopie et tracheo-bronoscopie. Semaine medicale vom 25. Oktober 1905.

(44) *Garel,* Gomme de la bifurcation des bronches; considerations sur la valeur diagnostique de la toux de compression dans les tumeurs du mediastin. Annales des maladies de l'Oreille du Larynx, etc., Tome XXXII, Nr. 7, 1906.

(45) *Garre, C., Quincke, H.,* Grundrib der Lungenchirurgie. Jena, G. Fischer, 1903.

(46) *Germain,* H. H., Foreign body in the bronchus. Journal of the American Medical Association vom 8. Juli 1905, Nr. 2.

(47) *Gleitsmann,* J. W., Diskussionsbemerkung zur Oesophagoskopie und Bronchoskopie. Report of the American Laryngolog. Assoc., Tome XXVII, S. 203, 1905.

(48) *Goldschmidt,* O., Sur un cas de papillomes situés dans la trachee, operè par la methode de Killian. Bull. de la Societe Belge d'Otologie et Laryngologie, Sitzung vom 12. Juni 1904.

(49) *Gottstein,* Uber die Diagnose und Therapie der Fremdkörper in den Bronchien und ihre Entfernung auf bronchoskopischem Wege. Bericht der 77. Versammlung deutscher Naturforscher und Arzte, Meran 1905, XVIII. Abteilung.

(50) *Guisez,* J., Corps etranger de la bronche droite extrait par la methode de la bronchoscopie. Bull. de la Societé de chirurgie vom 19. Februar 1905.

(51) *Guisez,* J., Tracheobronchoscopie et oesophagoscopie. Paris, Bailliere et Fils 1905, 93 Seiten.

(52) *Guisez,* J., Des resultats generaux obtenus par la broncho-esophagoscopie et des perfectionnements apportes a cette methode. Presse Medicale, Nr. 16, 1905.

(53) *Guisez, J. et Barret,* Cas d'extraction d'un corps etranger (piece de dix francs), de la bronche droite par la bronchoscopie superieure. Gazette des hopitaux, Nr. 28, 1905.

(54) *Gleitsmann* and *Mayer.* Laryngoscope, April, 1905.

(55) *Guisez.* Bull. et mem. de la Soc. Med. d'hopiteaux de Paris, Dec. 23. 1903.

(56) *v. Hacker,* V., Weitere Beitrage zur Fremdkörperentfernung mittelst oesophagoskopie. Deutsche medizinische Wochenschrift, Nr. 39, S 1535, 1905.

(57) *Hajek,* Entfernung eines Bolzens durch untere Tracheoskopie. Wiener klinische Wochenschrift, Nr. 17, S. 457, 1902.

(58) *Harrington,* Untere Bronchoskopie bei Fremdkörper. Boston medical and surgical Journal, Vol. CXLVI, Jahrg. 1901.

(59) *Heller,* R. und v. *Schrotter,* H., Die tracheae. Ein Beitrag zur Kenntnis der Bifurkation der Luftröhre etc. Denkschriften der k. Akademie der Wissenschaften in Wien, Bd. LXIV, 1897.

(60) *Helferich,* Ueber die Entfernung von Fremdkörpern aus den Bronchien und uber Bronchustamponade. Deutsche Zeitschr. fur Chirurgie, Bd. LXVII, S. 558, 1902.

(61) *Henrici,* Ein bronchoskopischer Fremdkörperfall. Archiv für Laryngologie, Bb. XVIII, Heft 2, S. 375, 1906.

(62) *Heydenreich,* H., Ein bronchoskopischer Fremdkörperfall. Deutsche med. Wochenschrift, Nr. 47, S. 1714, 1904.

(63) *Hinsberg.* Zur Extraktion von Fremdkörpern aus den Bronchien. Allgemeine med. Zentralzeitung, 75. Jahrg., Nr. 5, 1906.

(64) *Hoffman,* R., Fremdkörper im rechten Bronchus eines 1½ jahrigen Kindes im unteren Wege entfernt. Sitzungsber. der laryngo-otolog. Gesellschaft zu München vom 12. Marz 1906; s. Monatsschrift für Ohrenheilkunde, Nr. 8, S. 564, 1906.

(65) *Ingals,* E. F. Jour. Am. Med. As., Nov. 19, 1904.

(66) *Ingals,* E. F. Jour. Am. Med. As., May 27, 1905.

(67) *Johnsen,* Ch., Kasuistischer Beitrag zur Würdigung der Bronchoskopie; Nagel in der rechten Lunge. Inaug.-Diss., Kiel, Herbst 1905.

(68) *Just,* H., Entfernung eines Fremdkörpers aus dem rechten Hauptbronchus. Münchener med. Wochenschr., Nr. 15, 1904.

(69) *Jackson,* Chevalier, Laryngoscope, April, 1905.

(70) *Jackson,* Chevalier, Annals Otology, Rhinology, and Laryngology, Dec., 1906.

(71) *Jackson,* Chevalier, Thymic Tracheo-stenosis, Tracheoscopy, etc., Journ. Amer. Med. Asso. 1907.

(72) *Kaan,* P. Th. L., Entfernung eines Fremdkörpers aus dem rechten Bronchus mit Hilfe der unteren Endoskopie. Sitzungsbericht der niederlandischen Gesellschaft für Oto-Laryngologie, XIII. Tagung, 29. Oktober 1905; s. Tydschrift v. Geneeskunde vom 3. Februar 1906.

(73) *Kahler,* O., Demonstration eines Falles von stenose der Bronchein durch Sklerom, Sitzungsbericht der Wiener laryng. Gesellschaft vom 7. Marz 1906; s. Wiener klinische Wochenschrift, Nr. 17, 1906.

(74) *Kaufman,* Uber den Nachweis metallischer Körper mittelst der telephonischen Sonde etc. Festschrift für Th. Kocher, Wiesbaden 1891, J. F. Bergmann.

(75) *Kausch,* Fremdkörper der Luft—und Speisewege, Sitzungsbericht der Schlesischen Gesellschaft für vaterlandische Kultur, vom 21. Juli 1905.

(76) *Killian,* G., Uber direkte Bronchoskopie. Munchener medizinische Wochenschrift, Nr. 27, S. 844, 1898.

(77) *Killian,* G., Uber die Leistungen der direkten Bronchoskopie bei Fremdkörpern der Lungen. Münchener medizinische Wochenschrift, Nr. 22, S. 723, 1899.

(78) *Killian,* G., Die direkte Bronchoskopie and ihre Verwertung bei Fremdkörpern der Lungen. Wiener medizinische Wochenschrift, Nr. 1, S. 14, 1900.

(79) *Killian* G., Ein vier Jahre lang in der rechten Lunge steckendes Knochenstück auf naturlichem Wege entfernt. Deutsche medizinische Wochenschrift, Nr. 10, S. 161, 1900.

(80) *Killian,* G., Zur diagnostischen Verwertung der oberen Bronchoskopie bei Lungenkarzinom. Berliner klinische Wochenschrift, Nr. 14, S. 437, 1900.

(81) *Killian* G., Ein Bronchoskopie-Phantom. Archiv fur Laryngologie, Bd. XIII, Heft 1, S. 111, 1902.

(82) *Killian,* G., Ein Fall von Trachealsarkom. Archiv fur Laryngologie, Bd. XII., Heft 3, 1902.

(83) *Killian,* G., Mein sechzehnter bronchoskopischer Fremdkörperfall. Deutsche med. Wochenschrift, Nr. 33, S. 1206, 1904.

(84) *Killian* G., Die Tracheo-Bronchoskopie in diagnostischer und therapeutischer Hinsicht. Archiv fur klin. Chirurgie, Bd. LXXVII. Heft 2, 1905; sowie Annales des Maladies de l'Oreille etc., Tome XXXII, Nr. 3, 1906.

(85) *Killian,* G., Fremdkörper aus der Speiseröhre, der Trachea, den Bronchien etc. Verhandlungen des Vereines süddeutscher Laryngologen, Wurzburg 1905, S. 139; sowie Rev. hebdom. de Laryngologie etc., Vol. II, S. 97, 22. Juli 1905.

(86) *Killian,* G., Demonstration von Instrumenten zur Entfernung fremder Körper aus den Bronchien. Sitzungsbericht des XIII. Kongresses süddeutscher Laryngologen zu Heidelberg, 25. April 1906.

(87) *Killian,* G., Bronchoskopisches; Kregenknopf im linken, Knochenstück im rechten Hauptbronchus. sitzungsber. der XIII. Versammlung süddeutscher Laryngologen zu Heidelberg, Juni 1906.

(88) *Killian,* J. A., Entfernung einer Fischgrate aus dem linken Bronchus eines 3½ Jahrigen Kindes vom Munde aus mittelst der direkten oberen Bronchoskopie. Deutsche medizinische Wochenschrift, Nr. 52, S. 917, 1901.

(89) *Kirstein,* A., Die Autoskopie des Kehlkopfes und der Luftrohre. Berlin, O. Coblentz, 1906.

(90) *Kob,* M., Beitrage zur Killianschen Bronchoskopie. Medizinische Klink, Nr. 8, S. 177, 1905.

(91) *Kob,* M., Bronchoskopische Falle. Sitzungsbericht der Freien Vereinigung der Chirurgen Berlins vom. 9. Januar 1905; s. Deutsche medizinische Wochenschrift, Nr. 10, S. 404, 1905.

(92) *Kob,* M., Diskussion uber die Erfolge der Bronchoskopie. Sit-

zungsbericht der Gesellschaft der Charitearzte vom 23. November 1905.

(93) *Kob,* M., Bronchoskopie bei Lungenechinokokkus. Sitzungsber. der Gesellschaft der Charitearzte vom 31. Mai 1906; s. Münchener medizinische Wochenschrift Nr. 24, S. 1183, 1906.

(94) *Kob,* Bronchoskopie bei Fremdkörperverdacht. Sitzungsber. der Gesellschaft der Charitearzte vom 31. Mai 1906; s. Münchener medizinische Wochenscrift, Nr. 24, S. 1183, 1906.

(95) *Koch,* Extraktion eines Fremdkörpers aus einem Bronchus 11. Ordnung mit Hilfe des Killianschen Bronchoskopes. Sitzungsbericht der Berliner medizinischen Gesellschaft vom 2. November 1904; s. Berliner klinische Wochenschrift Nr. 46, S. 1205, 1904.

(96) *Kohn,* H., und *Meyer,* E., Ein Fall von Lungengangran. Demonstration in der Berliner medizinischen Gesellschaft vom 28. Juli 1905.

(97) *Kollofrath,* O., Entfernung eines Knochenstückes aus dem rechten Bronchus auf naturlichem wege unter Anwendung der direkten Laryngoskopie. Münchn. medizinische Wochenscrift, Nr. 38, 1897.

(98) *Killian,* G., Jour. Lar. Rhin. and Otol., September and October, 1902.

(99) *Kirstein,* A., Archiv. fur Lar., 111 Bd. Heft., 1 and 2.

(100) *Kirstein,* A., Berlin kl. W., 1895, No. 22.

(101) *Lafite-Dupont et Rocher,* Bronchoscopie superieure pour l'extraction d'un noyau de prune de la bronche droite. Gazette hebd. des sciences med. de Bordeaux vom 12. November 1905.

(102) *Lermoyez, M. et Guisez,* Histoire d'un clou et d'un noyau de pruneau enclaves dans les bronches. Presse Medicale, Nr. 102, 1907.

(103) *Lindt.* Technique de la bronchoscopie. Bull. de la Societe medico-pharmaceutique de l'arrondissement de Berne vom 12. Januar 1904.

(104) *Lindt,* Mitteilung eines Falles von Kokainontoxikation nach unterer Bronchoskopie. Sitzungsber. der XIII. Versammlung süddeutscher Laryngologen zu Heidelberg, Jani 1906.

(105) *Lins,* A., Extraktion eines Fremdkörpers aus dem linken Bronchus. Annales des maladies de l'Oreille etc., Tome XXXI, Nr. 11, S. 462, 1905.

(106) *Lombard Et Sebileau.* Nadel in rechten Hauptbronchus. Bull. de la Societé de chirurg. vom 17. Mai 1905.

(107) *Lowy,* A. und v. Schrotter, H., Untersuchungen uber die Blut-

zirkulation beim Menschen. Zeitschrift für experimentelle Pathologie and Therapie, Bd. I, 1904 (ist auch als selbstandiger Druck bei A. Hirschwald, Berlin erschienen).

(108) *Mann,* Bronchoskopie in einem Falle von Tuberkulose der Bronchialdrüsen. Sitzungbericht der Gesellschaft fur Natur—und Heilkunde zu Dresden vom 21. Oktober 1905; s. Münchener medizinische Wochenschrift, Nr. 8, 1906.

(109) *Manasse,* Demonstration zur Broncho—und oesophagoskopie. Sitzungsbericht des Artztevereins in Strassburg vom 27. Mai 1905; Deutsche medizinische Wochenschrift, Nr. 38, S. 151, 1905.

(110) *Meunier,* H., Corps etranger de la bronche droit extrait après tracheotomie. Bull. de la Societè de Chirurgie vom 17. Februar 1904.

(111) *Meyer,* E., Uber Erfahrungen mit den direkten Untersuchungsmethoden der oberen Luftwege. Berliner klinische Wochenschrift, Nr. 37, S. 1173, 1905.

(112) *Meyer,* E., Diskussion uber die Erfolge der Bronchoskopie. Sitzungsbericht der Gesellschaft der Charitearzte vom 23. November 1905.

(113) *Mosher,* Bronchoskopy and Tracheoskopy. Sitzungsbericht der XI. Versammlung der American. laryngol. Association vom 5. und 6. Juni 1905.

(114) *Moure,* E. J., Corps etrangers des bronches et bronchoscopie. Revue hebdomadaire de laryngologie, Jahrg. 1906.

(115) *Macintire,* J., Jour. Lar. Rhin. and Otol., September, 1902.

(116) *Mackenzie,* Morell. Med. Times and Gazette, 1881, vol. 2, p. 60.

(117) *Mikulicz,* von. Centralb. fur Chirurg., 1881, No. 43, p. 673.

(118) *Morton,* W. C., Jour. Lar., Rhin. and Otol., January, 1906.

(119) *Nehrkorn,* Zur direkten Bronchoskopie zwecks Extraktion quelbarer Fremdkörper. Deutsche medizinische Wochenschrift, Nr. 40, S. 1457, 1904.

(120) *Neumayer,* H., Demonstrationsvortrag über Bronschoskopie. Bericht des arztlichen Vereines in München. Deutsche medizinische Wochenschrift, Nr. 23, 1900.

(121) *Neumayer,* H., Uber Bronschoskopie. Münchener medizinische Wochenschrift, Nr. 38 u. 39, 1904.

(122) *Neumayer,* H., Bronchoskopie bei Endotheliom der Lunge. Sitzungsber. der laryngol. Gesellschaft in München vom 22 Mai, 1905, s. Monatsschrift für Ohrenheilkunde, Nr. 12, 1905.

(123) *Nowotny,* F., Zur Diagnose des Aortenaneurysmas. Archiv für Laryngologie, Bd. XIV., Heft 1, 1902.

(124) *Nowotny,* F., Beitrag zur Kasuistik der inspirierten Fremdkörper. Montasschrift für Ohrenheilkunde, Nr. 8, S. 341, 1904.

(125) *Nowotny,* F., Uber die Tracheo und Bronchostenosen. Archiv für Laryngologie, Bd. XVII., Heft 2, 1905.

(126) *Nowotny,* F., Beitrag zur Kasuistik der Framdkörper in den Bronchiem. Przeglad Lekarski, Nr. 25, 1905.

(127) *Newcomb,* James E., Annals Otology, Rhinology and Laryngology, December, 1906.

(128) *Paterson,* Fremdkörper in der Trachea mittelst oberer Bronchoskopie entfernt. Sitzungsbericht der Londoner laryngologischen Gesellschaft vom 3. June, 1904.

(129) *Paunz,* Fall von Bronchoskopia directa. Orvosi hetilap, Nr. 44, 1905.

(130) *Pich,* Entfernung von Fremdkörpern aus den Luftwegen. Riforma medica, Nr. 13, 1904.

(131) *Pieniazek,* P., Extraktion eines kleinen Bolzens aus dem rechten unteren Bronchialaste 11. Ordnung. Wiener medizinische Blätter, Nr. 1 ung 2, 1888.

(132) *Pieniazek,* P., Uber die Spekulierung der Luftröhre durch die Trachealfistel (Tracheoskopie) nach ausgeführter Tracheotomie. Wiener medizinische Blätter, Nr. 44 und 46, 1889.

(133) *Pieniazek,* P., Die Tracheoskopie und die tracheoskopischen Operationen bei Tracheotomierten. Archiv für Laryngologie, Bd. IV., S. 210, 1896.

(134) *Pieniazek, P.,* Die Verengerungen der Luftwege. Wien, 1901, Franz Deutike.

(135) *Pieniazek,* P., Eigene Kasuistik der inspirierten Fremdkörper nebst Bemerkungen über die Extraktion derselben aus den tieferen Luftwegen. Monatsschrift für Ohrenheilkunde, Nr. 12, S. 529, 1903.

(136) *Pieniazek,* P., Bemerkungen über das Asthma bronchiale. Wiener klin. Wochenschrift, Nr. 46, 1905.

(137) *Pieniazek,* P., Traitement local sous le controle de la vue des retrecissements de la trachee et des bronches. Archives internationales de Laryngolog, d' otologie, etc., Tome XX., Nr. 6, S. 681, 1905.

(138) *Pieniazek,* P., Die Kompression der Luftröhre durch Wirbelabszeb. Wiener medizinische Wochenschrift, Nr. 27, S. 1337, 1906.

(139) *Pommerenig,* E., Fremdkörperfall. Sitzungsbericht des Vereins der Arzte in Prag vom 22. April, 1904.

(140) *Poch,* R., Ein Framdkörper in der Lunge. Lokalisation mittelst

der Rontgenstrahlen. Wiener klinische Wochenschrift, Nr. 46, S. 1065, 1896.

(141) *Pochoy,* V. J. B., Indications et contre-indications de la bronchoscopie superieure et inferieure dans les corps etrangers des voies aeriennes. Thése de Bordeaux, Dezember, 1905.

(142) *Prota,* G., L' elettrocalamita applicata all' extrazione die corpi stranieri metallici dalle vie aeree. Archivi Italiani di Laringologia, 23. Jahrg., Fasc. 1, 1903.

(143) *Pianiazek,* Muench, med. Woch., 1898, p. 723.

(144) *Reinhard,* P., Bronchoskopie dei Syphilis der tieferen Luftwege. Monatsschrift für Ohrenheilkunde, Nr. 11, S. 497, 1905.

(145) *De Roaldes,* The management of foreign bodies from the air passages. Reprint of Louisiana State Medical Society, 1900, sowie Bericht der American Laryngological Association, Mai 1901.

(146) *Russel, Hamilton, R.,* with notes by Fox, William, R., Removal of a large pin from the lower lobe of the lung by transpleural pneumotomy. Lancet, Nr. 4280, vom 9. September, 1905.

(147) *Roe,* J. O. Burnett's System of Diseases of the Nose and Throat, Phil., 1893.

(148) *Schech,* Extraktion eines fremden Körpers aus dem linken Bronchus. Sitzungsber. der X. Versammlung süddeutscher Laryngologen zu Heiledberg, S. 647, Juni 1903.

(149) *Schefold,* E., Uber die Verwendung der Killianschen Bronchoskopie bei der Pneumotomie. Inaug.-Diss., Tubingen, 1904, bzw. Beitrage zur klinischen Chirurgie, Bd. XLIII., Heft 3.

(150) *Schmidt,* K., Nubschale im linken Bronchus. Russk. Wratsch, Nr. 32, 1904.

(151) v. *Schrotter,* H., Zur Kenntnis der Knochenneubildung in der Luftröhre. Wiener klinische Wochenschrift, Nr. 15, S. 414, 1899.

(152) v. *Schrotter,* H., Gelungene Entfernung eines Fremdkörpers aus der rechten Lunge auf unblutigen Wege. Sitzungsber. der k. k. Gesellschaft der Arzte in Wien vom 24. November und 15. Dezember, 1899; s. Wiener klinische Wochenschrift, Nr. 48, bzw. 51, 1899.

(153) v. *Schrotter,* H., Zur Aetiologie und Therapie tiefsitzender Stenosen der Luftwege. Deutsche medizinische Wochenschrift, Nr. 28, S. 459, 1901.

(154) v. *Schrotter,* H., Uber Stenosierung der Pulmonalarterie, zugleich ein Beitrag zur Kenntnis der Metastasierung der Uteruskarzinoms, Deutsche Arztezeitung, Heft 21, 1901.

(155) v. *Schrotter,* H., Extraktion eines Fremdkörpers aus der rechten Lunge mittelst direkter Bronchoskopie. Wiener klinische Wochenschrift, Nr. 45, S. 1196, 1902.

(156) v. *Schrotter,* H., Zur Therapie tiefsitzender Stenosen der Luftwege. Sitzungsbericht der oto-larying. Sekt. des XIV. internation. Kongresses in Madrid, April, 1903.

(157) v. *Schrotter,* H., Heilung eines Falles von Pneumothorax. Sitzungsber. des Vereins für innere Medizin in Wien vom 9. Juni, 1904; s. Wiener medizinische Wochenschrift, Nr. 26, 1904.

(158) v. *Schrotter,* H., Demonstration tracheo, und bronchoskopischer Bilder mit dem Projektionsapparate. Sitzungsber. d. Vereins f. inn. Medizin in Wien vom 23. Marz 1905; s. Wiener medizinische Wochenschrift, Nr. 14, 1905.

(159) v. *Schrotter,* H., Zur Diagnose und Therapie der Lungengangran. Medizin. Klinik, Nr. 22, S. 745, 1905.

(160) v. *Schrotter,* H., Klinischer Beitrag zur Bronchoskpoie. Münchener medizinische Wochenschrift, Nr. 26, S. 1241, 1905.

(161) v. *Schrotter,* H., Fremdkörperfall der Luftröhre. Wiener med. Presse, Nr. 1, S. 18, 1906.

(162) v. *Schrotter,* H., Uber Syphilis an der Teilungsstelle der Luftröhre. Monatsschrift fur Ohrenheilkunde, Nr. 1, S. 11, 1906.

(163) v. *Schrotter,* H., Uber Bewegungsercheinungen an den menschlichen Bronchien. Wiener klinische Rundschau, Nr. 15, S. 281, 1906.

(164) v. *Schrotter,* H., Zur diagnostischen Verwendung der Endoskopie bei Lungenkrankheiten. Wiener klinische Wochenschrift, Nr. 33, S. 1001, 1906.

(165) v. *Schrotter,* H., Beitrage zur Klinik der Bronchoskopie (Karzinom der rechten Lunge). Sitzungsber. der XIII. Versammlung süddeutscher Laryngologen zu Heidelberg, Juni 1906.

(166) v. *Schrotter,* L., Beobachtungen über eine Bewegung der Trachea und der groben Bronchien mittelst des Kehlkopfspiegels. Sitzungsber. der k. Akademie der Wissenschaften, Bd. LXV, Abt. III, Juli 1872.

(167) v. *Schrotter,* L., Krankheiten der Luftröhre. Wien, w. Braumuller & Sohne, 1896.

(168) v. *Schrotter,* L., Zur Kasuistik der Fremdkörper in den Luftwegen. Stuttgart, F. Enke, 1901.

(169) v. *Schrotter,* L., Uber ein neues Beleuchtungsinstrument etc. Sitzungsbericht des Vereins f. innere Medizin in Wien vom 22.

Marz 1906. s. Wiener medizinische Wochenschrift, Nr. 17, 1906.

(170) v. *Schrotter,* L., Diskussionsbemerkungen zu einem Vortrage von L. Hofbauer. Sitzungsbericht des Vereins fur innere Medizin in Wien vom 3. Mai 1906; s. Wiener medizinische Wochenschrift, Nr. 22. S. 1099, 1906.

(171) v. *Schrotter,* L., Demonstration einer neuen Untersuchungslampe. Sitzungsber. der deutschen otologischen Gesellschatf, Wien, Juni 1906.

(172) *Schwyzer,* A., New York, Medical Record vom 9. April 1904, sowie Annales of Surgery, H. 2, 1904.

(173) *Sebileau,* Bronchoskopie bei Fremdkörpern. Bull. de la Societe de chirurgie vom 3. Mai 1905.

(174) *Sidney-Jankauer,* Foreign body in the bronchus: removal with the aid of the bronchoscope; Recovery. New York Medical Record vom 11. Februar 1905.

(175) *Siebenmann,* F., Tracheobronchoskopische Fremdkörperfalle. Korrespondenzbl. für Schweizer Arzte, 36. Jahrg., Nr. 4, 1905.

(176) *Spiess,* G., Ein Fremdkörper in der Lunge. Münchener medizinische Wochenschrift, Nr. 13, 1901.

(177) *Spiess,* G., Ein Fremdkörper im linken Hauptbronchus. Deutsche medizinische Wochenschrift, Nr. 8, 1903.

(178) *Sprengel,* Zur Verwendung der Bronchoskopie. Bericht des XXXIV. Kongresses der deutschen Gesellschaft fur Chirurgie, Berlin 1905.

(179) *Starck,* H., Die direkte Besichtigung der Speiseröhre, Osophagoskopie. Wurzburg, A. Stuber, 1905.

(180) *Stoerk.* Munch. med. Woch., 1881, pages 210 and 706, 860.

(181) *Stillman,* F. L., Ohio State Med. Jour., March, 1906.

(182) v. *Schrotter,* H., Klinik d. Bronchoscopie, Fischer, Jena. 1906.

(183) *Simpson,* Wm. K., Annals Otology, Rhinology & Laryngology—Dec. 1906.

(184) *Tapia,* J., Deux mots pour donner une denomination exacte a la bronchoscopie superieure et inferieure. Annales des maladies de l'Oreille etc., Tome XXXII, Nr. 4, S. 389, 1906.

(185) *Texier.* Uber Bronchoskopie. Gazette de Nantes, Jahrg. 1903 (Pef. nach Pochoy).

(186) *Tillmanns,* Vergebliche Extraktionsversuche bei Fremdkörpern im Bronchus. Sitzungsbericht der freien Vereinigung der Chirurgen Berlins vom 9. Januar 1905; s. Deutsche medizinische Wochenschrift, Nr. 10, S. 404, 1905.

(187) *Thost,* A., Zwei Falle von Fremdkörpern in den Bronchien. Monatsschrift fur Ohrenheilkunde, Nr. 4, S. 141, 1905.

(188) *Theisen,* Clement F., Annals Otology, Rhinology & Laryngology Dec. 1906.

(189) *Varenne,* G., Extraction des Corps etrangers magnetiques des voies aeriennes par l'electro-aimant. Thèse de Bordeaux 1901.

(190) *Vierordt,* O., Diagnostik der inneren Krankheiten. 7. Auflage, S. 674 u. 679, Leipzig 1905.

(191) *Warnecke,* Acht Jahre Autoskopie des Kehlkopfes und der Luftröhre. Beitrange zur klin. Medizin; Festschrift fur H. Senator, S. 423-428. Berlin, A. Hirschwald, 1904.

(192) *Weinberger,* M., Atlas der Radiographie der Brustorgane. Wien, E. M. Engel, 1901.

(193) *Weinberger,* M., Der gegenwartige Stand der Rontgendiagnostik innerer Krankheiten. Wiener Klinik, 32. Jahrg., Heft 1 und 2, 1906.

(194) *Wild,* O., Zwei neue bronchoskopische Fremdkörperfalle. Arch. fur Laryngol., Bd. XII, Heft 2, 1900.

(195) *Wild,* O., Die Untersuchung der Luftröhre und die Verwendung der Tracheoskopie bei Struma. Beitrage zur klin. Chirurgie, Bd. XIV, Heft 1, 1905.

(196) *Witzel,* O., Uber Fremdkörper in den Bronchien. Sitzungsbericht der niederrheinischen Gesellschaft fur Natur und Heilkunde zu Bonn, 1904.

(197) *Winkler,* Extraktion eines Fremdkörpers aus den Bronchien. Sitzungsbericht der XII. Versammlung süddeutscher Laryngologen zu Heidelberg vom 12. Juni 1905; s. Münchener medizinische Wochenschrift, Nr. 33, 1905.

(198) *Willis,* M. W. Lancet, December 10, 1904.

(199) *Wood,* G. B. Phil. Month. Med. Jour., June, 1899.

(200) *Yankauer.* Laryngoscope, April, 1905.

BIBLIOGRAPHY, OESOPHAGOSCOPY AND GASTROSCOPY.

(201) *Astier,* De l'examen de l'oesophage a l'aide du miroir laryngoscopique. Le progrès medical. 1881. Nr. 18. S. 336. (Kurze Beschreibung und Abbildung des ersten gegliederten Stoerk' schen Osophagoscopes.)

(202) *Balacescu u. Kohn,* Die aussere cervikale Oesophagotomie zur Extraktion von Fremdkörpern im Oesophagus. Arch. f. kl. Chir. 1904. Bd. 72, S. 347.

(203) *Baratoux, J.,* De l'oesophagoscopie et de la gastroscopie. Paris 1882.

(204) *Bauermeister,* W., Zur Semiologie des oesophagoskopischen Bildes (kollaterales stenosierendes Oedem der unteren Speiseröhre bei Magenkrebs.) Arch. f. Verd. 1904, Bd. X, H. 5, S. 520.

(205) *Bevan,* J. A., Oesophagoscope. The Lancet. 1868. Bd. 1, S. 470.

(206) *Bevan,* Oesophagoscope. The Lancet. 1868. Bd. 1, S. 516.

(207) *Bozinni,* Ph., Der Lichtleiter oder Beschreibung einer einfachen Vorrichtung und ihrer Anwendung zur Erleuchtung innerer Hohlen und Zwischenraume des lebenden animalischen Körpers. Wiemar 1807.

(208) *Brun,* H , Ein Grensdivertikel des Oesophagus. Beitrage zur kl. Chir. 1904. Bd. 41, S. 198.

(209) *Cruise,* Fr. R., The utility of the Endoscope as an aid in the Diagnosis and treatment of Disease. The Dublin quarterly journal of medical science Bd. 39, 1865, S. 329.

(210) *Duperron,* R. H., L'oesophagoskopie (Technique et valeur clinique). Thèse de Bordeaux 1902.

(211) *Danielsohn,* Das Glucksmann'sche Verfahren der Oesophagoskopie. Therap. Monatshefte 1904, Nr. 11.

(212) *Denker,* Uber Oesophagoskopie und Bronchoskopie. Vortrag gehalten im arztl. Bezirksverein zu Erlangen. 28. Nov. 1904.

(213) *Ebstein,* Demonstration eines Instrumentes zur endoskopischen Dilatations-behandlung. Wien. laryngol. Gesellsch. Juni 1896. Wien. klin. Wochenschr. 1896. Nr. 26, S. 590, s. a. Vortrag im Wien. med. Club. 23. Marz 1898. Wien. klin. Wochenschr. 1898, S. 357.

(214) *Ebstein,* Uber Oesophagoskopie und ihre therapeutische Verwendbarkeit. Wiener klin. Wochenschr. 1898, Nr. 6, S. 119, s. a. Braumuller Wien u. Leipzig 1898.

(215) *Ebstein,* Demonstration einer Laugenveratzung. Gesellsch. der Arzte in Wien. 27. Mai 1898, S. 546.

(216) *Ebstein,* Fremdkörper in der Speiseröhre. Vortrag in der Wiener laryngolog. Gesellsch. 5, I. 99. Wiener klin. Wochenschr. 1899, Nr. 4, S. 91.

(217) *Ehrlich,* 19 Speiseröhrenfalle: Referat Berl. klin. Wochenschr. 1898, Nr. 40, S. 896.

(218) *Ehrlich,* Oesophagusstenose infolge von Scharlachdiphtherie. Heilung. Berl. klin. Wochenschr. 1898, Nr. 42, S. 927.

(219) *Ehrlich,* Diskussion zu dem Vortrag von Guttentag über idiopathische Erweiterung des Oesophagus. Berl. klin. Wochenschr. 1900, Nr. 2, S. 41.

(220) v. *Eicken,* C., Ein Sarkom der Speiserohre. Deutsche Zeitschr. f. Chir. Bd. 65. Vortrag gehalten im Vereine Freiburger Arzte am 27. Juni 1902.

(221) v. *Eicken,* Die klin. Verwertung der direkten Untersuchungsmethoden der Luftwege und der oberen Speisewege. Arch. f. Laryngol. Bd. 15, H. 3.

(222) *Einhorn,* M., Die Inspektion des Osophagus und der Kardia. New York Med. Jour. 1897, 11. Dez. Referat: Laryngolog. Zentralbl. 1898, S. 421.

(223) *Einhorn,* Uber ein neues Oesophagoskop (Demonstration). Vortrag gehalten 9. Dez. 1901 vor der Med. Association of Greater-New-York. Berl. klin. Wochenschr. 1902, Nr. 51, S. 1200.

(224) *Ewald,* Sitzungsbericht der Berl. med. Gesellschaft. 4. Ill. 1896. Berl. klin. Wochenschr. 1896, Nr. 11, S. 239.

(225) *Fackeldey,* Uber einen interessanten Fall von vermeintlichem Fremdkörper in der Speiseröhre eines Kindes von 1½ Jahren. Vortrag im Verein westdeutscher Hals—und Ohrenarzte, Koln, 24. April 1904. Münch. med. Wochenschrift 1904, S. 1624.

(226) *Glucksmann,* G., Demonstration eines neuen Oesophagoskopes. Vortrag geh. in d. Berl. med. Gesellsch., Sitzung vom 7. Jan. 1903. Berliner klin. Wochenschr. 1903, Nr. 4.

(227) *Gluckmann,* Ziele, Fortschritte und Bedeutung der Oesophogoskopie. Berl. klin. Wochenschrift 1904. Nr. 23.

(228) *Glucksmann,* Die Spiegeluntersuchung der Speisewege. 76. Vers. deutsch. Naturf. und Arzte zu Breslau 1904.

(229) *Gordon King,* Oesophagoscopy and its application in two cases New Orleans med. Journ. Oct. 1899. Laryngolog. Zentralbl. 1900, S. 356.

(230) *Gottstein,* G., Uber Oesophagoskopie. Vortrag geh. a. d. 69. Vers. deutsch. Naturf. und Arzte in Braunschweig 1897.

(231) *Gottstein,* Diskussion zum Vortrage von v. Hacker: Uber Oesophagoskopie. Moskauer internat. Kongr. 1897.—Wiener klin. Wochenschr. 1897, Nr. 46.

(232) *Gottstein,* Uber seltene Erkrankungen der Speiseröhre und deren diagnostische Feststellung durch das Oesophagoskop. Allgem. med. Zentr.—Ztg. 1900, Nr. 20, S. 236.

(233) *Gottstein,* Ein Fall von Fremdkörper (Gebiss) in der Pars cardiaca des Magens, diagnostiziert durch Radiographie und Oesophagoskopie. Gastrotomie. Heilung. Deutsche med. Wochenschr. 1901, Nr. 23.

(234) *Gottstein,* Demonstration eines Falles von Cardiospasmus wäh-

rend der Behandlung, sowie eines Patienten mit Aktinomykose des Oesophagus. Schles. Gesellsch. f. vaterland. Kultur., med. Sektion, 1. Marz 1901. Allgem. med. Zentr.-Ztg. 1901, Nr. 23.

(235) *Gottstein,* Die diagnostische Bedeutung der Probeexzision auf oesophagoskopischem Wege. Arch. f. klin. Chir. Bd. 65, Heft 1.

(236) *Gottstein,* Technik und Klinik der Oesophagoskopie. Mitteilungen aus den Grenzgeb. d. Medizin und Chirurgie, Bd. 6 u. 8. 1901.

(237) *Gottstein,* Zur Technik der Oesophagoskopie. 76. Vers. deutsch. Naturf. u. Arzte zu Breslau. Sektion f. Chir. 1904.

(238) *Grunfeld,* Jos., Zur Geschichte der Endoskopi eund der endoskopischen Apparate. Medizinische Jahrbücher Jahrg. 1879, S. 237.

(239) *Guttentag,* Demonstration zweier Patienten mit narbigen Oesophagusstenosen Vortrag geh. im wissenschaftl. Verein d. Arzte zu Stettin. Sitzung vom 8. Mai 1900. Berl. klin. Wochenschr. 1900. Nr. 39, S. 872.

(240) *Gussenbauer,* Diskussion zu Mikulicz' Vortrag auf dem XI. Chirurgenkongress. S. Verhandlungen S. 52.

(241) v. *Hacker,* (Oesophagoskopie bei Karzinom, Atzstrikturen, Fremdkörpern). Gesellsch. der Arzte in Wien, Mai 1889. Wien. klin. Wochenschr. 1889, Nr. 23, S. 469.

(242) v. *Hacker,* Demonstration. Fremdkörperextraktion im Oesophagoskop. Gesellsch. d. Arzte in Wien, 25. Okt. 1889. Wien klin. Wochenschr. 1889, S. 847.

(243) v. *Hacker,* Uber die nach Veratzungen entstandenen Speiseröhren-Verengerungen. Wien 1889. Alfred Holder, S. 54 u. 108.

(244) v. *Hacker,* Uber dic Erfolge der Gastrostomien mit Sphinkterbildung aus dem Musculus rectus abdominis. Wien. klin. Wochenschr. 1890, Nr. 36 u. 37.

(245) v. *Hacker,* Zur Behandlung tiefsitzender Narbenstrikturen der Speiseröhre durch Sondierung ohne Ende nach temporarer Gastrostomie und Oesophagostomie. Wien klin. Wochenschr. 1894, Nr. 25. S. 455. Nr. 26. S. 480.

(246) v. *Hacker,* Uber die Bedeutung der Elektro-Endoskopie der Speiseröhre im allgemeinen und für die Entfernung von Fremdkörpern aus derselben im besonderen. Wien. klin. Wochenschr. 1894, Nr. 49, S. 919, Nr. 50, S. 946, s. auch Verhandlung d. 66. Naturforscher—Vers. Wien 1894.

(247) v. *Hacker,* Sphinkterbildung aus dem Musculus rectus und die

Kombination der Sphinkterbildung mit Witzel's Kanalbildung bei der Gastrostomie. Beitr. zur klin. Chirurgie 1896, Bd. 17, S. 409.

(248) v. *Hacker,* Uber die Technik der Oesophagoskopie. Wein. klin. Wochenschr. 1896, Nr. 6, S. 91, Nr. 7, S. 110.

Die Oesophagoskopie und ihre klinische Redeutung. Beitr. zur klin. Chirurgie Bd. XX, Heft 1, S. 141; s. Verhandlg. des XII. international. mediz. Kongr. zu Moskau, 1897; s. a. Diskussion hierzu: Gottstein, Rosenheim. Wiener klin. Wochenschr. 1897, Nr. 46, S. 1022.

(249) v. *Hacker,* Erfahrungen über die Entfernung von Fremdkörpern mittelst der Oesophagoskopie (mit Demonstration der entfernten Fremdkörper). Verhandlungen d. Deutsch. Gesellsch. f. Chirurgie, 27. Kongress 1898, S. 144.

(250) v. *Hacker* u. Lotheissen, G., Die angeborenen Missbildungen, Verletzungen und Erkrankungen der Speiseröhre. Handb. d. prakt. Chirurgie 1900. Ferd. Enke, Stuttgart. I. Die Untersuchungsmethoden der Speiseröhre. Bd. 11, S. 397.

(251) *v. Hacker,* Die Oesophagoskopie beim Krebs der Speiseröhre und des Mageneinganges. Beitr. zur klin. Chirurgie Bd. XX, H. 2, S. 275.

(252) *v. Hacker,* Uber die Entfernung von Fremdkörpern aus der Speiseröhre mittelst der Oesophagoskopie. Beitr. zur klin. Chirurgie Bd. 29, 1901, S. 128.

(253) *v. Hacker,* Zur operativen Behandlung der periosophagealen und mediastinalen Phlegmone nebst Bemerkungen zur Technik der kollaren und dorsalen Mediastinotomie. Arch. f. klin. Chirurgie 1901, Bd. 64, S. 478 (s. a. Verhandlung des 30. Chirurgenkongresses).

(254) *Harmer,* L., Klinik der Oesophagoskopie. Wien klin. Wochenschr. 1902, Nr. 35, S. 884.

(255) *Hartman,* A., Zur Kasuistik der Oesophagotomie nebst eninigen Bemerkungen uber die Bedeutung der Oesophagoskopie und Durchleuchtung mit Rontgenstrahlen bei verschluckten Fremdkörpern. Diss. Freiburg i. Br. 1902.

(256) *Hartman,* O., Uber einige oesophagoskopierte Falle. Deutsche Zeitscher f. hir. 1904, Bd. 71, S. 594.

(257) *Hodlmoser,* C., Zur Diagnose des latenten Oesophaguskarzinoms. Wien. klin. Wochenschr. 1900, Nr. 44, S. 1007.

(258) *Hofmann,* C., Die Beleuchtung und Besichtigung der Speiseröhre mittels oesophagoskops von der Kardia aus; retrograde Oesophagoskopie. Zentr.—Bl. f. Chirurgie 1901, Nr. 29, S. 729.

(259) *Jackson,* Chevalier, Laryngoscope, 1905.

(260) *Jackson,* Chevalier, Annals of Otology, Rhinology and Laryngology (Frankel Festschrift) December, 1906.

(261) *Jackson,* Chevalier, Archives Internationales de Laryngologie, Rhinologie et d'Otologie, Mch.-Apr., 1907.

(262) *Jackson,* Chevalier, Gastroscopy, New York Medical Record. 1907.

(263) *Kaloyeropulos,* J., Uber Oesophagoskopie und Oesophagotomie bei Fremdkörpern in der Speiseröhre. Beitr. z. klin. Chir. 1903, Bd. 38, S. 540.

(264) *Karewski,* Diskussion zu dem Vortrag von Rosenheim uber Spasmus und Atonie der Speiseröhre. Verein für innere Medizin in Berlin. Sitzung vom 5. Juni 1899. Berl. klin. Wochenschr. 1899, S. 554.

(265) *Kelling,* G., Zur Diagnostik des tiefsitzenden Speiseröhrendivertikels. Münch. med. Wochenschr. 1894, Nr. 47, S. 930.

(266) *Kelling,* Zur Oesophagoskopie und Gastroskopie. Arch. f. Verd. —Krankh. 1896, Bd. 11, S. 321.

(267) *Kelling,* Mitteilung zur Benutzung des Oesophagoskops. Allg. med. Zentralzeitung 1896, Nr. 7, S. 73.

(268) *Kelling,* Beitrage zur Untersuchung in der Speiseröhre. Verhandl. der Gesellsch. deutsch. Naturforscher u. Arzte 1896, S. 50.

(269) *Kelling,* Endoskopie fur Speiseröhre und Magen. 1. Gegliedertes Oesophagoskop, welches durch Zug und Drehung streckbar ist. Münch. med. Wochenschr. 1897, Nr. 34, S. 934.

(270) *Kelling,* Lähmung des untern Oesophagusteiles. Jahresber. der Gesellsch. f. Natur und Heilkunde in Dresden. Sitzung vom 20. Febr. 1897, S. 84.

(271) *Kelling,* Physiologische und technische Beitrage zur Untersuchung der Speiseröhre und des Magens. Jahresber. d. Gesellsch. f. Natur-und Heilkunde in Dresden 1897. S. 190.

(272) *Kelling,* Uber Oesophagoskopie mit biegsamen Instrumenten. 27. Kongr. d. Deutsch. Gesellsch. f. Chir. 1898, S. 753.

(273) *Kelling,* Demonstration der Besichtigung der Speiseröhre mit biegsamen Instrument. Allgem. med. Zentr.-Ztg. 1898, Nr. 65, S. 799.

(274) *Kelling,* Sonde zum Photographieren der Speiseröhre. Arch. f. Verd.-Krankh. 1898, H. 3, S. 299.

(275) *Kelling,* Endoscopy of the Oesophagus and Stomach. Lancet 28. April 1900.

(276) *Kelling,* Bemerkungen zu dem Vortrag von Dr. Glucksmann:

Ziele, Forteschritte und Bedeutung der Oesophagoskopie. Arch. f. Verd.-Krankheiten 1904, Bd. 10, H. 4, S. 411.

(277) *Killian,* G., Die oesophagoskopische Diagnose des Pulsionsdivertikels der Speiseröhre. Vortrag gehalten auf der 6. Vers. süddeutsch. Laryngol. Heidelberg. 3. April 1899, s. auch Münch. med. Wochenschr. 1900, S. 112.

(278) *Killian,* Kurze Anleitung zur Technik der direkten Untersuchgsmethoden der Luft-und Speisewege. Für die Besucher der 70. Jahresversammlung der British Medical Association als Manuskript gedruckt.

(279) *Killian,* Uber die Entfernung von Fremdkörpern aus den Luft- und Speisewegen. 20. Oberrheinischer Arztetag 26. Juli 1899. Munch. med. Wochenschr. 1899, Nr. 32.

(280) *Killian,* Ein schwieriger oesophagoskopischer Fall. Deutsch. med. Wochenschr. 1900, Nr. 51, S. 829.

(281) *Killian,* Zur Geschichte der Oesophago-und Gastroskopie. Deutsch. Zeitscher. f. hir. 1901, Bd. 58, S. 499.

(282) *Killian-Worms,* Akuter Verschluss der Speiseröhre bei einem fünfjahrigen Kinde. Beseitigung auf oesophagoskopischem Wege. Vortrag gehalten auf d. 9. Vers. süddeutsch. Laryngol. Heidelberg, 19. Mai 1902.

(283) *Kirstein,* Uber Oesophagoskopie. Ber. klin. Wochenschr. 1898, S. 594. (Vortrag gehalten auf d. 5. Vers. suddeutsch. Laryngologen zu Heidelberg 30. Mai 1898), ebenso in Berl. med. Gesellsch. 8. Juni 1898.

(284) *Kirstein,* Die Besichtigung der Regio retrolaryngealis. Allgem. med. Zentr.-Zeitg. 1898, Nr. 89, S. 1095.

(285) *Kraus,* F., Die Erkränkungen der Mundhohle und der Speiseröhre. Wien 1902. Alfr. Holder (in Nothnagel's spez. Pathol. u. Ther. Bd. XVI, Teil 1, Abteilung 11).

(286) *Kretschmann,* Demonstration eines Oesophagoskopes. Med. Gesellsch. von Magdeberg 22. Nov. 1900.

(287) *Kussmaul,* Magenspiegelung. Bericht der naturforsch. Gesellsch. Zu Freiburg i. Br. 21. Juli 1868, Bd. 5, S. 112.

(288) *Landauer,* Ein Fall von tiefsitzendem Oesophagusdivertikel. Zentr.-Bl. f. innere Medizin 1899, Nr. 16.

(289) *Leiter,* Uber neue Beleuchtungsapparate mit Zuhilfenahme des elektrischen Lichtes zu diagnostischen und operativen Zwecken in und ausserhalb der menschlichen Körperhohlen. Wien 1887, 1889 u. 1895.

(290) *Lewandowski,* Elektrodiagnostik und Elektrotherapie einschliesslich der physikalischen Propadeutik fur prakt. Arzte. Wien 1887, S. 309.

(291) *Lotheissen,* G., Die Oesophagoskopie beim Divertikel. Arch. f. klin. Chir. Bd. 71, H. 4.

(292) *Lowie,* L., Beitrage zur Oesophagoskopie. Deutsch. med. Wochenschr. 1893, Nr. 12.

(293) *Mackenzie, Morell,* On the use of the oesophagoscope in disease of the gullet. The Medical Times and Gazette. New Series. Bd. 11, 1881, S. 60.

(294) *Mackenzie,* Die Krankheiten des Halses und der Nase. Übersetzt von Semon 1884 11., S. 24.

(295) *Mayr, K. u. Dehler, A.,* Beitrag zur Diagnose und Therapie der Divertikel der Speiseröhre. Münch. med. Wochenschr, 1901, Nr. 37.

(296) *Merkel,* F., Uber Oesophagoskopie. Vortrag gehalten im Stuttgarter arztl. Verein am 1. Juli 1897. Med. Korrespond.-Bl. des wurtt. arztl. Landesvereins. 1897, Bd. 67, Nr. 29.

(297) *Merkel,* F., Uber Oesophagoskopie. Vortrag gehalten im arztlichen Bezirksverein I. (Stuttgart) Med. Korrespond.-Bl. d. wurtt. arztl. Landesvereins. 1898, Bd. 68, Nr. 34.

(298) *Meyer,* Ed., Uber Autoskopie und Oesophagoskopie. Allg. med. Zentral-Zeitung 1895, Nr. 100, S. 1201.

(299) v. *Mikulicz,* J., Ueber Gastroskopie und Oesophagoskopie. Zentralbl. f. Chirurgie 1881, Nr. 43, S. 673.

(300) *v. Mikulicz,* J., Ueber Gastroskopie und Oesophagoskopie. Wien. med. Presse 1881, Nr. 45. S. 1405; Nr. 46, S. 1437; Nr. 47, S. 1473; Nr. 48, S. 1505; Nr. 49, S. 1537.

(301) *v. Mikulicz,* J., Ueber Gastroskopie und Oesophagoskopie. mit Demonstrationen am Lebenden. Verhandlungen der Deutsch. Gesellsch. f. Chirurgie XI. Kongress. Berlin 1882, S. 30.

(302) *v. Mikulicz,* J., Beitrage zur Physiologie der Speiseröhre und der Kardia. Mitteil. aus den Grenzgebieten der Med. u. Chir. 1903, XII. S. 569.

(303) *Mikulicz,* Wiener Klin. Wochenschrift, 1183 vol. 33, No. 23-24. Leading Article Esophagoscopy and Gastroscopy. Medical Times, May 5, 1883.

(304) *Neuenborn,* Discussion zu dem Vortrag von Fackeldey. Münch. med. Wochenschr. 1904, S. 1625.

(305) *Oser,* Ueber Gastroskopie Wien. Med. Bl. 1881 vol. 4 p. 1598.

(306) *Pariser,* Diskussion zum Vortrag von Rosenheim über Sondierung der Speiseröhre im Oesophagoskop. Berl. klin. Wochenschr. 1897, Nr. 22, S. 478.

(307) *Perl,* J., Anatomische und klinische Beitrage zur Begrundung der Gastroskopie. Zeitschr. f. klin. Med. 1896, XXIX. S. 494.

(308) *Pick,* F., Demonstration eines Stein-und Glasessers. Sitzungsber. des Vereines deutscher Arzte in Prag. 7. Febr. 1896. Prag. med. Wochenschr. 1896, Bd. 21, Nr. 8.

(309) *Pigger,* H., Beitrage zur Lehre des Speiseröhrenkrebses mit besonderer Berücksichtigung der neuesten diagnostischen und therapeutischen Bestrebungen. Diss. Gottingen 1899.

(310) *Reizenstein,* Zur Klinik der Speiseröhrenerkrankungen mit Demonstration. Münch. med. Wochenschr. 1900. Nr. 31, S. 1089.

(311) *Reizenstein,* Die Besichtigung der Speiseröhre vom Munde aus (Oesophagoskopie und vom Magen aus (retrograde Oesophagoskopie). Festschr. zur Feier des 50 jahr. Bestehens des arztl. Vereins Nurnberg 1902.

(312) *Reizenstein,* Nachweis und Extraktion von Fremdkörpern der Speiseröhre mit Hilfe des Oesophagoskopes. Vortr. geh. im arztl. Lokalverein Nurnberg 5. I. 05, s. a. Munch. med. Wochenschrift 1905.

(313) *Rozenstein,* Ueber die Dilatation cicatricieller Stenosen der Speiseröhre mit Hilfe des Oesophagoskopes. Vortr. geh. am 1. XH. 04 im arztlichen Lokalverein Nurnberg.

(314) *Rosenfeld,* C., Die Verwendung der Rontgenstrahlen in der inneren Medizin. Allg. med. Zentr.-Zeitschr. 1896, Nr. 98, S. 1177, Nr. 99, S. 1189.

(315) *Rosenheim,* Th., Beitrage zur Oesophagoskopie. I. Oesophagoskopische Bilder beim Speiseröhrenkrebs. Deutsche med. Wochenschr. 1895, Nr. 50. S. 836.

(316) *Rosenheim,* Th., Ueber Oesophagoskopie. Berlin. klin. Wochenschr. 1895, Nr. 12, S. 247. (Vortrag mit Demonstration) gehal. in der Berliner med. Gesellschaft 13. Marz. 1895.)

(317) *Rosenheim,* Th., Ueber die Besichtigung der Kardia nebst Bemerkungen uber Gastroskopie. Deutsche med. Wochenschr. 1895, Nr. 45, S. 740.

(318) *Rosenheim,* Th., Ueber die Neurosen des Oesophagus. Allg. med. Zentral-Zeitung 1895, Nr. 98, S. 1173, Nr. 99, S. 1189.

(319) *Rosenheim,* Th., Pathologie und Therapie der Krankheiten der Verdauungsorgane. Teil I. Krankheiten der Speiseröhre und des Magens einschliesslich der Gastroskopie und Oesophagoskopie. Wien (Urban und Schwarzenberg) 1896.

(320) *Rosenheim,* Th., Ueber Oesophagoskopie und Gastroskopie. Deutsche med. Wochenschr. 1896, Nr. 43, S. 688.

(321) *Rosenheim,* Th., Uber Gastroskopie (mit Demonstration). Berl. klin. Wochenschr. 1896, Nr. 13, S. 239 u. s. 275. (Vortrag gehalten in d. Berl. med. Gesellsch. 4. Marz 1896.)

(322) *Rosenheim,* Th., Uber Fremdkörperextraktion aus dem Oesophagus. Berl. klin. Wochenschr. 1896. Nr. 48. S. 1072. Vortrag d. Berl. med. Gesellsch. 11. Nov. 1896.

(323) *Rosenheim,* Th., Ueber Sondierung Speiseröhre im Oesophagoskop. Berl. med. Gesellsch. 12. Mai 1897. Berliner med. Wochenschr. 1897. Nr. 22.

(324) *Rosenheim,* Th., Ueber Heilung eines Falles von Oesophagusstriktur nach Diphtherie. Vortrag gehalten in d. Berl. med. Gesellschaft 11. Mai 1898. Berliner klin. Wochenschr. 1898, Nr. 22, S. 496.

(325) *Rosenheim,* Th., Ueber einige Behandlungsmethoden bei Speiseröhrenerkrankungen. Therapie d. Gegenw. 1899, H. 2, S. 56.

(326) *Rosenheim,* Th., Beitrage zur Oesophagoskopie. (Ueber einige seltenere Oesophagealerkrankungen und ihre diagnostische Abgrenzung vom Krebs.) Deutsche med. Wochenschr. 1899, Nr. 4 u. 5, S. 53 u. 75.

(327) *Rosenheim,* Th., Ueber Spasmus und Atonie der Speiseröhre. Verein f. innere Medizin Berlin. Sitzung vom 5. Juni 1899.

(328) *Rosenheim,* Th., Beitrage zur Kenntnis der Divertikel und Ektasieen der Speiseröhre. Zeitschr. f. klin. Medizin. Bd. 41, H. 1-4, S. 177.

(329) *Rosenheim,* Th., Uber Oesophagusstenose. Deutsche Klinik 1901.

(330) *Rewidzoff,* P.

1. Noch einige Worte über mein Gumme-Gastrostrop. Ach. f. Verdauungskr. Berl. 1899. vol. 5 p. 484.

2. Zur Teknik der Gastroskopie (Modification des Rosenheimschen Gastroskopie (Cong. Internal Med. Cong. Mosc. 1899, III. Sect. 5, p. 214.

(331) *Schilling,* F., Erkankungen der Speiseröhre und Oesophagoskopie. Wien. med. Blatter. 1901, Nr. 36.

(332) *Schilling,* Die Krankheiten der Speiseröhre. Leipzig 1903.

(333) *Schmillinsky,* Demonstration eines Falles von Oesophaguskarzinom. Vortrag gehalten im arztl. Verein Hamberg. Sitzung vom 2. Mai 1899. Münch. med. Wochenschr. 1899, Nr. 20, S. 680.

(334) *Schmilinsky,* Zur Diagnose der pharyngo-ösophagealen Pulsionsdivertikel. Deutsche med. Wochenschr. 1901, Nr. 33, S. 556.

(335) *Schreiber,* J., Ein Oesophagoskop. Arch. f. Verd.-Krankheiten. 1902. VIII. S. 243.

(336) *v. Schrotter,* H., Beitrag zur Oesophagoskopie bei Fremdkörpern. Wien. med. Wochenschr. 1904, Nr. 45 u. 46.

(337) *v. Schrotter,* H., Weiterhin Beitrag zur Oesophagoskopie bei Fremdkörpern. Monatsschr. f. Ohrenheilkunde 1904, Nr. 11.

(338) *Schworer,* R., Ein Fall von spindelformiger Erweiterung der Speiseröhre. Münch med. Wocheschr. 1899. Nr. 25, S. 825.

(339) *Segalas,* Revue medicale francaise et etrangère. 1827, I. S. 157.

(340) *Semeleder,* Wien Medizinalhalle. 1862, Nr. 34, S. 319 (zit. n. Killian).

(341) *Starck,* H., Die diffuse Erweitung der Speiseröhre. Deutsche Praxis. Zeitschr. f. prakt. Arzte. 1903. Nr. 7 u. 8.

(342) *Starck,* Die ösophagoskopische Diagnose divertikelartiger Erweiterungen der Speiseröhre. Arch. für Verdauungskrankheiten. Bd. XI.

(343) *Starck,* H., Bericht über ösophagoskopische Diagnostik. Münch. med. Wochenschr. 1904. Nr. 6.

(344) *Starck,* H., Fremdkörperextraktion im Oesophagoskop. Vortrag im naturhist. med. Verein Heidelberg 8. XI. 04, s. Münch. med. Wochenschr. 1905, Nr. 8.

(345) *Starck,* H., Die Oesophagoskopie und ihr diagnostischer Wert. Vortr. XIV. internat. med. Kongr. Madrid April 1903, s. Petersburgher med. Wochenschr. 1903, Nr. 26.

(346) *Stein,* Th., Das Photo-Endoskop. Berliner klin. Wochenschr. 1874, Nr. 3, S. 31.

(347) *Stoerk,* Ein neues Oesophagoskop. Wien. med. Wochenschr. 1887. Nr. 34. S. 1117.

(348) *Stoerk,* Die Untersuchung des Oesophagus mit dem Kehlkopfspiegel. Wien. med. Wochenschr. 1881, Nr. 8, S. 210, Nr. 25, S. 706, Nr. 30, S. 860.

(349) *Stoerk,* Ueber Oesophagoskopie. Naturforscher-Versammlung in Wien 1894.

(350) *Stoerk,* Die Untersuchung der Speiseröhre (Oesophagoskopie). Wien und Leipzig. Wilhelm Braummuller. 1896 (s. auch Die Oesophagoskopie. Wiener klin. Wochenschr. 1896. Nr. 28, S. 625, s. auch Wien. laryngol. Gesellsch. 1896. Wien klin. Wochenschr. 1896. Nr. 26, S. 590).

(351) *Strauss,* H., Klinische Beitrage zur Pathologie und Therapie der sogenannten idiopathischen Oesophagus-Erweiterung ("sackformige Oesophagus-Erweiterung ohne anat. Stenose"). Zeitschr. f. klin. Medizin 1901. Bd. 44. H. 3 u. 4.

(352) *Stubenrauch,* Mehrfache luetische Strikturen des Oesophagus. Gastrostomie. Retrograde Sondierung ohne Ende. Rasche Besserung. Vortrag gehalten im arzt. Verein. München Sit-

zung vom 11. Nov. 1900. Münch. med. Wochenschrift 1901, Nr. 6. S. 240.

(353) *Starck,* H., Esophagoscopy, A. Stuber, Wurzburg, 1905.

(354) *Treitel.* Demonstration eines Oesophagoskopes. Berliner med. Gesellsch. 6. Marz 1895. (Dan Oesophagoskop entspricht einem der altesten Modelle, mittelst welchem man die Wandung des obersten Speiseröhrenabschnittes übersieht) s. auch laryngolog. Gesellsch. Berlin 7. Dez, 1904.

(355) *Voltolini,* Sitzung der Gesellschaft für wissenschaftliche Medizin in Berlin vom 2. Juli 1860. Deutsche Klinik 1860, S. 393.

(356) *Waldenburg,* L., Oesophagoskopie. Eine neue Untersuchungsmethode. Berl. klin. Wochenschr. 1870, Nr. 48, S. 578.

(357) *Winternitz,* A., Fremdkörperextraktion aus dem Osophagus im Oesophagoskop. Vortrag im Budapester kon. Arzteverein 19. Okt. 1901. Wien. med. Wochenschr. 1902, S. 378.

(358) *v. Zander,* Ein grosser Fremdkörper in der Speiseröhre. Charite-Annalen 1898, Bd. 23, S. 501.

DESCRIPTION OF PLATES.

Plate I.

1. Tracheal papilloma. Girl of 4 years. Removed through tracheoscope. Referred by Dr. Brush.

2. Tracheal compression by struma. Feeble pulsatory excursion. Man of 33 years. Referred by Dr. Heard.

3. Tracheal compression by aneurysm. Violent pulsatory excursion. Dotted line shows limit of recession of bulging. Man of 60 years referred by Dr. Price.

4. Cicatrical stenotic web in trachea resulting from ulceration caused by a foreign body in the esophagus. Child 2 years of age. Referred by Dr. Ryall.

5. Scabbard trachea. Thymic tracheo-stenosis. Cured by thymectomy. Child of 4 years. Referred by Dr. Boyce.

6. Egg shell in edematous larynx. In situ 4 weeks. Removed by direct laryngoscopy. Infant 9 months of age. Referred by Dr. Moyer and Dr. Wechsler.

7. Button fixed in the trachea by the swollen mucosa. Whistling respiration. Boy of 14 years. Referred by Dr. Crawford.

8. Luetic tracheal stenosis. Man 24 years of age. Referred by Dr. F. T. Smith.

9. Compression stenosis of the trachea by an esophageal carcinoma. Man aged 60. Referred by Dr. Sanes.

Plate II.

10. View looking down left bronchus. To the left above is the opening of the superior lobe bronchus. To the right the inferior lobe bronchus.

11. Normal view looking down right bronchus. Above is the middle lobe bronchus; below to the left the inferior lobe bronchus; to the right the superior lobe bronchus, appearing larger because nearer.

12. Fungating granulations from healing cartilage, after tracheotomy. Skin allowed to unite *per primam.*

13. Primary tracheal ozena. Girl aged 16 years. Referred by Dr. Wallace.

14. Stenosis from luetic cicatrices. Right bronchus of man aged 23 years. Referred by Dr. F. T. Smith.

15. Compression stenosis of trachea. Posterior wall bulged forward by tubercular lymph nodes. Woman aged 25 years. Referred by Dr. Schildecker.

Plate III.

1. Introitus esophagi. Normal. Dark line must not be understood as a gaping. Collapsed shut. Man of 36.

2. Intra-thoracic esophagus. Unusual view, but normal. More usual appearance shown in Fig. I., Plate IV.

3. Esophagus at hiatus diaphragmatis normal. Note axis of lumen. Man of 60.

4. Cicatricial esophageal stenosis. Pin-hole lumen. White scars. Recurrence of stenosis following ulceration during typhoid fever. Primary lesion, burned by swallowing lye in childhood 14 years previously. Mr. H. aged 21 years. Referred by Dr. Stevenson.

5. Ibid. Bottom of diverticulum. Mucosa chronically inflamed.

6. Tubercular ulceration posterior esophageal wall, simulating decubitus ulcer often seen in typhoid fever. Tubercular lesion in this location is somewhat rare, though still more rarely is it diagnosticated. Incidentally this figure shows the introitus esophagi when the cricoid cartilage is lifted by the laryngeal speculum. Compare Fig. I., above.

7. Carcinoma of the thoracic esophageal wall (left) covered with normal mucosa. Lumen pushed to the right and almost obliterated. Man aged 60 years, referred by Dr. Sanes.

8. Carcinoma, endo-esophageal. Woman of 41 years, referred for chronic nasal sinus disease. Esophageal symptoms slight and attributed to globus hystericus.

9 and 12. Fibroma papillare, attached by long slender fibrous peduncle. Disappeared into the esophagus at times after swallowing. Fig. 12 shows the attachment within the esophagus when the cricoid cartilage is moved forward (instrument not shown). Removed through tubular speculum. Man aged 36 years, referred by Dr. Heard.

10. View in thoracic esophagus showing wounds (above) made by blind groping with a coin extractor which did not extract. Boy of 14 years.

11. Wound in esophageal wall made by a pin which was afterward found higher up. Woman of 23 years, referred by Dr. Pool.

13. Normal. "Kink" of the esophagus at the hiatus, probably more a preventive of regurgitation than the cardia.

14. Peri-esophageal carcinoma overlaid with normal mucosa, lumen deviated so far to right as to be out of view. Diagnosis upon hardness of mass, and age of the patient. Man of 60 years, referred by Dr. Swope.

15. Stomach ulcer (on left side of right fold in the view), bed showing dark after secretions had been wiped away. Other folds normal. Woman aged 26 years, sent by Dr. Moss.

16. Stomach. Normal. Branched fold. Dark crimson color. Examined one hour after drinking milk. Man of 32 years.

17. Stomach. Carcinoma. Zone of hyperemia. Man of 46 years, referred by Dr. Walton.

18. Stomach. Same patient. Mulberry-like nodule at another portion of growth.

Plate IV.

1. Thoracic esophagus. Expiration. Note lumen not entirely closed. Man aged 40.

2, 3, 4, 5 and 6. Normal stomach. Folds in various positions as seen separating and collapsing ahead of the tube as it is inserted and withdrawn. In Fig. 4 is shown a horseshoe-shaped position of a fold often seen near the cardia, usually to the right. At times seen elsewhere. Compare Figs. 16 and 18, Plate V.

7 and 8. Stomach. Normal wall of inferior curvature flattened by pressure of the tube mouth.

9. Gastritis. Fold in lower right hand corner is capped by secretion simulating ulcer, before wiped away.

10. Gastritis. All folds sponged but one, which shows thick tenacious secretion.

11. Gastric ulcer seen on edge. Not sponged. Man aged 32. Patient of Dr. Finkelpearl.

12. Same patient. Scar after healing of the ulcer. Scar shows yellow by engraver's error; it should be grayish, nearly white.

13. Carcinoma of cardia. Infiltrated but not ulcerated hard mass to right of view. Man 38 years. Referred by Dr. Haworth.

14. Same patient. Farther to right than Fig. 13, on lesser curvature. Fungating portion of mass.

15. Carcinoma of pylorus. Left border of the tumor. Man of 44 years. Referred by Dr. Haworth.

16. Normal stomach. Three cm. below the cardia. Note horseshoe-shaped fold to the right. Maid of 19 years. Patient of Dr. Lichty.

17. Normal stomach, farther down, same patient. (Views are never twice alike, no form is meant as typical of locality.)

18. Normal stomach. Four cm. from cardia. Woman of 33 years.

19. Normal stomach. Woman of 19 years. Showing diversified forms of folds.

20. Normal stomach. Transverse trend of folds as greater curvature is approached. Folds are rarely seen as straight as the central one in this view.

21. Approaching the pyloris. Gastroptotic stomach. (View probably not abnormal.) Woman of 33 years. Referred by Dr. Dranga.

22. Gastroptotic stomach (same patient). Pyloris hidden by folds.

23. Folds at fundus (not typical).

24. Approaching the pyloris. Folds disturbed by tube-mouth. Same patient as Fig. 21.

25. Same patient, same location, about one minute later.

26. Ditto, about one minute later. Annular folds of pyloris surrounding prolapsed duodenal folds. Brownish fluid was regurgitated into stomach.

27. Cancerous (?) infiltration near pyloris. Fluid exuded from triangular slit. Woman aged 26 years. Referred by Dr. Montgomery.

28. Gastric ulcer, filled with secretion, and seen on edge. Man aged 59 years. Referred by Dr. Goldsmith.

29. Same ulcer wiped clean. Looking into bed of ulcer.

30. Cicatrix (?) of stomach, in a man 59 years of age who had a specific history.

31. Carcinoma of esophagus. Man of 60 years, referred by Dr. Sanes.

32. Carcinoma (?) of pyloris. View not at, but near the pyloris on greaer curvature. Color should be much darker. Woman aged 26 years. Referred by Dr. Montgomery.

33. Carcinoma of pyloris. View at left border. Other portions of growth were spotted with dark brown. Man 46 years of age. Referred by Dr. Walton. Afterward operated upon by Dr. MacClelland and diagnosis as to size, shape, position and nature verified.

34. Another portion of same growth. Mucosa normal but foldless and hard. (Right in view.)

35. Cardiospasm. Abdominal esophagismus. Man aged 59 years. Referred by Dr. Goldsmith.

PLATE I.

PLATE II.

PLATE III.

PLATE IV.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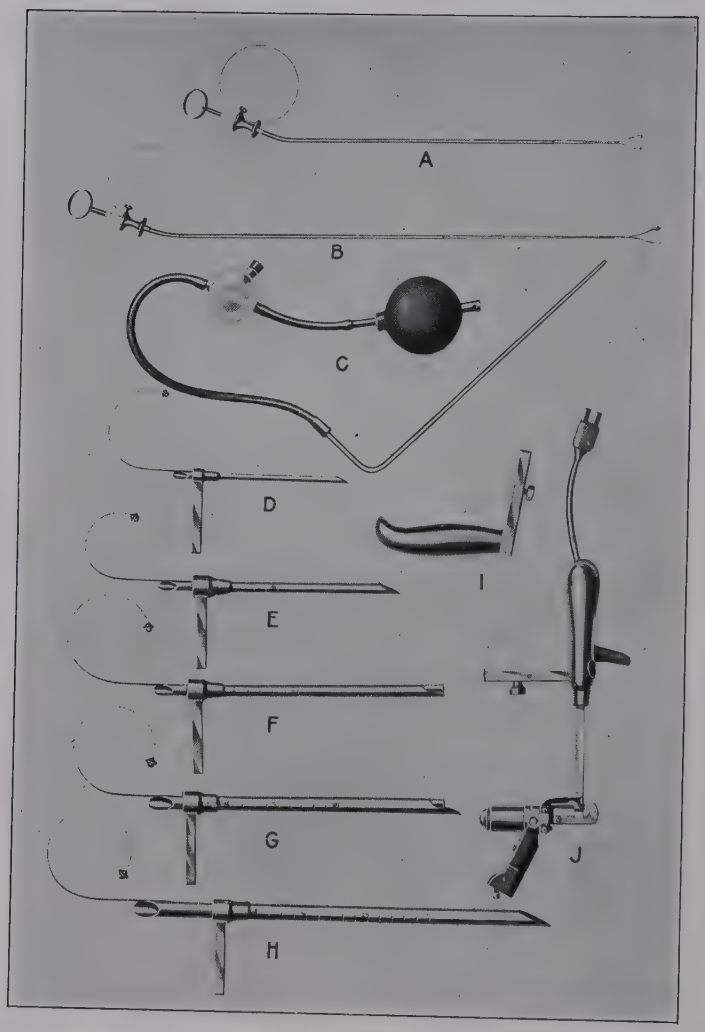
GASTROSCOPIC VIEWS

PLATE V.

APPENDIX.



Von Eicken's Forceps and Brünings' Bronchoscopes.
A, B, Forceps, large and small, adjustable in length.
C, Aspirator.
D, E, F, G, H, Tubes of different sizes.
I, Handle for use on tubes when using the Kirstein headlamp.
J, Handlamp for illumination of tube.

While this book was in press, Professor Gustav Killian, upon a visit to this country, exhibited the bronchoscopic tubes of Brüning's. These consist essentially of a long tube-spatula in which an inner tube telescopes (D, E, F, G, H). The inner tube has at one side a long slender piece of coiled steel, like a watch spring, which, when the inner tube is pushed in until flush with the outer tube, serves to push the inner tube as much farther as desired.

The illumination is by a hand lamp (J) attached to the outer end of the outer tube, the light mirror being thrown out of the way when it is desired to introduce an aspirator, cotton carriers or other instruments. In the event of the giving out of the hand lamp, the Kirstein headlamp is used, and may be preferred by some operators, though the hand lamp will be found best for use during introduction of the instruments. The handle (I) may be used instead of the hand lamp, when a headlamp is used for illumination.

In use, the outer tube of tube-spatular form is inserted over the dorsum of the tongue, posterior to the epiglottis, and into and through the glottis into the upper end of the trachea. Then the inner telescopic tube is inserted into the tube-spatula and pushed downward as far as desired.

A forceps (A, B), which also telescopes so as to permit of shortening and lengthening, was designed by Von Eicken.

At C is shown an aspirator, the tube of which is inserted into the bronchoscope as often as needed.

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